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Teacher Thoughts on Infographics as Alternative Assessment: A Post-Secondary Educational Exploration

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DEDICATION

This dissertation is dedicated to the memory of
my Mother and Grandfather; you inspired me creatively, challenged
me intellectually, and supported me completely.

This dissertation is also dedicated to my wife, Jennifer
for her continuous support and encouragement
throughout this journey.

ACKNOWLEDGMENTS

ABSTRACT

This qualitative phenomenological case study is designed to investigate the learning outcomes, lived experiences, and perceptions of eight post-secondary teachers participating in a sketch-based infographic development training program. This research is designed to assess the viability of infographics as a learning and assessment strategy, providing insight into the application of infographics to the post-secondary education environment, and informing the development of an instructional and assessment model with prescriptive conditions for usage and training. This research provides much needed empirical support for specific applications of visualization tools in the post-secondary learning environment with a specific focus on teacher perspectives providing additional insight into visual skill development, learning environment considerations, training requirements and support implications associated with infographics. This study revealed five (5) major themes associated with the use of infographics as alternative assessment in post-secondary education. These five interconnected themes include Using Infographics, Teaching Infographics, Developing Infographics, Assessing with Infographics and Infographics and Learning. A prescriptive model and approach for using, teaching, developing, and assessing infographics in post-secondary educational settings is presented.

Keywords: alternative assessment, cognitive mapping, creative assessment, drawing, graphic facilitation, graphic organizers, infographics, sketchnotes, visualization, visual learning, visual literacy, visual note taking, visual thinking.

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CHAPTER ONE

INTRODUCTION

"To envision information – and what bright and splendid visions can result – is to work at the intersection of image, word, number, art" (Tufte, 1990, p.9).

The Post-Secondary Learning Environment

The post-secondary learning environment continues to be dominated by traditional forms of instruction and assessment. Despite the need to address changing student demographics (Hay, Tan, & Whaites, 2010) and changing learning processes in post-secondary education (Anderson, 1998), many post-secondary instructors remain reliant on the lecture format of instruction (Gur, Dilci, Coskun, & Delican, 2013; Kiewra, 2002) and traditional, objective-based assessment techniques to evaluate learning (Anderson, 1998).

Some argue (Sanders, 2001; Taras, 2002) that post-secondary education is failing to cultivate and encourage critical, higher-order thinking and according to Taras (2002), failing to develop learners that can think on their own, focusing more on the attainment of objectives and less on improving learning. This reliance on assessment as a method to gauge completion of an objective rather than as a tool to inform and influence educational practices falls short of capturing the actual learning taking place, and negatively influences the opportunity to use assessment to inform pedagogy (Buhagiar, 2007; Offerdahl & Tomanek, 2011; Sanders, 2001; Taras, 2002; Torrance, 2007).

Others suggest that traditional assessment techniques disengage students from the learning process (Drake, 2001; Taras, 2002) failing to measure and quantify learning (Drake, 2001), doing little to inform instructional practices (Herman, 1992), and may actually be inhibiting and adversely influencing the learning process (Buhagiar, 2007).

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To complicate the issue, many students are unsatisfied with the seeming reliance on traditional, summative forms of assessment in post-secondary education (Taras, 2002).

There exists a need to evaluate current assessment practices in post-secondary education (Sanders, 2001; Tepper, 2004), moving away from, or at least, releasing the reliance on, traditional assessments by evaluating, exchanging or supplementing these traditional assessment techniques with creative and alternative assessment approaches (Anderson, 1998; Drake, 2001; Sanders, 2001; Tepper, 2004). These new and alternative forms of assessment can be utilized as a flexible (Sparapani, 2000; Tepper, 2004), creative (Corcorran, Dershimer, & Tichenor, 2004; Mullen, 2010), exciting (Tepper, 2004; Purnell, 1999) and engaging learning strategy (Buhagiar, 2007; Sanders, 2001) for capturing and communicating learning (Drake, 2001) in more meaningful and imaginative ways (Purnell, 1999). Alternative forms of assessment benefit learners in many way (Tepper, 2004) and provide instructors with a variety of multiple, diverse forms of evaluating learning (Buhagiar, 2007; Mullen, 2011; Sanders, 2001; Shepard, 1989; Valencia, 1990) enabling a much broader view of learning (Ewing, 1998). Further, alternative assessments promote autonomous and self-directed learning pathways for students (Anderson, 1998; Allen & Flippo, 2002; Sparapani, 2000) and provide instructors with means to evaluating the manifestation of student learning not possible with traditional forms of assessment (Britton, 2011; Drake, 2001; MacKenzie & Zinn, 2008; Sanders, 2001).

It has been suggested (Shepard, 1989) that students benefit from challenging and authentic learning strategies that empower them with opportunities to make sense of new material. Alternative assessment approaches may provide this opportunity. One such

alternative assessment strategy might be the use of infographics in post-secondary education.

Information Visualization and Communication

For thousands of years, humans have utilized graphics and visualizations to communicate and to inform. From cave paintings in prehistoric France, to the use of hieroglyphic icons and symbols in ancient Egypt (Smiciklas, 2012; Virag, 2013), visual communication and visualization techniques have been adapted, modified, and utilized to convey information. Throughout the middle ages and into the Renaissance, early information visualization pioneers began to combine text with graphics to promote understanding and to enhance communication of ideas (Smiciklas, 2012). From the late eighteenth century through the twentieth century, combinations of text and graphical components have been increasingly utilized. Use of information visualizations continue today and are readily apparent in popular media such as newspapers and magazines where information visualizations are used to augment and supplement written text to aid comprehension and understanding (Smiciklas, 2012; Virag, 2013). Emerging from the late twentieth century, a pervasive and specific form of information visualization known collectively as infographics have emerged and flourished in our digital society and are evolving from use in print media into a variety of different contexts (Toth, 2013).

Infographics

Information graphics, or infographics, are visual representations of data (Moorefield-Lang, 2011) that creatively combine and arrange text and various graphical components to tell a visual story about a particular topic (Lamb & Johnson, 2014a; Toth, 2013; Virag, 2013). Through a process of inquiry and research, infographics are used to

distill, refine, and communicate data (Abilock & Williams, 2014; Gallicano, Ekachai & Freeberg, 2014; Lamb & Johnson, 2014b) by accurately, visually, and creatively conveying and simplifying complex data to an understandable, compelling, and visually appealing form (Gallicano, et al. 2014). Further, infographics are utilized to support a perspective (Gallicano et al, 2014), persuade an audience (Abilock & Williams, 2014; Toth, 2013), develop and support an argument, and to demonstrate understanding (Gallicano, et al,. 2014; Abilock & Williams, 2014; Toth, 2013). Infographics have emerged as a primary tool for providing instruction and conveying information about a topic (Yildirim, 2016) and according to Cifci (2016) infographics are "student-centered instructional materials which synthesize information and visualization, and which encourage multi-dimensional and analytical thinking." (p.155)

The educational application of information visualization forms such as infographics are informed by and based upon extant learning strategies and perspectives encompassing the realms of visual thinking, visual learning, visualization, graphic organizers, and drawing.

Visual Thinking, Visual Learning, and Visualization

Visual thinking is the transformation, manipulation, and modification of information resulting from the processes of seeing, imagining, and developing visual representations (McKim, 1980). Visual learning is using imagery and graphics to understand, interpret, and convey information (Chmela-Jones, Buys, & Gaede, 2007). Visualization is the confluence of thinking, understanding, and communication involving a process of externalizing thoughts and ideas by mapping internal conceptions to an

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external visual format informed by existing knowledge and thought processes (Hanks & Belliston, 1977; Ziemkiewicz & Kosara, 2009).

Educators need ways to engage and assist students with learning, recalling, and applying new concepts (Ermis, 2008; Robinson & Kiewra, 1995) and need ways to evaluate current knowledge in order to prescribe targeted and specific instruction (McMackin & Witherell, 2005). An opportunity exists for educators and the research community to explore the use of visual frameworks (Reyes, 2011) as new pathways to develop and expand knowledge, skills, and abilities (Sundeen, 2007).

Visual thinking and learning have been shown to be effective teaching and learning techniques (Rezabek, 2005; Long & Carlson, 2011; Ntuen, Park, & Gwang-Myung, 2010) that cultivate mental model construction (Schnotz & Kurschner, 2008; Gooding, 2004) and assist in the establishment of cognitive frameworks to improve understanding (Ntuen, et al., 2010). Visual thinking and learning strategies are developed from and based on an underlying visual literacy. Visual literacy is the ability to match visual constructs to the appropriate context for the purpose of developing cognitive, creative, and communicative processes and abilities (Brown, 2014) and is the foundation necessary to develop specific visual thinking and learning applications such as infographics in post-secondary contexts.

Graphic Organizers

Graphic organizers (GOs) are two-dimensional visual displays of concepts that represent and identify relationships utilizing spatial formatting, placement, and orientation of text (Katayama & Robinson, 2000) that provide frameworks for helping learners describe relationships between important concepts (Hoffman, 2003; Porcaro,

2012; Reyes, 2011). Graphic organizers have been found to be effective learning formats for representing current knowledge, gaps in knowledge, and knowledge gains (Alshatti, Watters, & Kidman, 2010; Hall, Kent, McCulley, Davis, & Wanzek, 2013). The use of the graphical format helps to attract, focus, and stimulate learner interest (Porcaro, 2012) and may provide a solution to address previously described issues surrounding the need for application of alternative assessment strategies in post-secondary contexts.

Drawing as a Learning Strategy

The process of drawing has been shown to be an effective strategy for developing meaning and understanding of information as well as providing support for associated development of other learning functions (Kouvou, 2006; VanMeter, 2001). Drawing may be an effective learning strategy but additional research is needed to confirm the viability and instructional implementation potential of this learning strategy (VanMeter, 2001).

Convergence of an Alternative Assessment Strategy

The research is clear on the positive educational impacts and effects of visual thinking, drawing, and graphic organizers. The proven educational application of visual thinking, visual learning, graphical organizers and drawing seem to converge and coalesce on infographics as a potentially viable alternative assessment for post-secondary education. However, there is an apparent gap or void in the literature regarding the use of infographics as alternative assessment in post-secondary education. Unknown are the implications and impacts and influence of infographics teaching, learning, and assessment strategy.

Alternative assessments have been shown to benefit students in many ways. Alternative forms of assessment contribute to greater understanding (Allen & Flippo,

2002; Anderson, 1998; Drake, 2001; Tepper, 2004; Purnell, 1999), promote student engagement (Allen & Flippo, 2002; Corcoran et al., 2004; Sanders, 2001; Sparapani, 2000; Tepper, 2004), stimulate excitement and interest for learning (Purnell, 1999; Tepper, 2004), and impart flexibility and autonomy into the learning process (Anderson, 1998; Allen & Flippo, 2002; Sparapani, 2000; Tepper, 2004). In addition, alternative assessments can encourage creativity (Sparapani, 2000; Purnell, 1999), stimulate and cultivate imaginative, collaborative learning environments (Purnell, 1999) and help to establish a holistic, connected approach to teaching and learning (Anderson, 1998).

Infographics, as a form of alternative assessments share these characteristics and provide specific learner benefits. Infographic activities promote an iterative (Davidson, 2014) process of inquiry (Abilock & Williams, 2014; Lamb & Johnson, 2014a) and exploration (Howes & Stevenson, 2013; Virag, 2013; Zuk, 2011), that develops research skills (Davidson, 2014; Gallicano et al., 2014; Howes & Stevenson, 2013; Lamb & Johnson, 2014a; Toth, 2013), cultivates critical evaluation, analytical, and assessment skills (Lamb & Johnson, 2014b; Toth, 2013), and develops skills associated with synthesizing and conveying thought (Davidson, 2014; Gallicano et al., 2014; Moorefield-Lang, 2011).

Although the learning benefits of alternative assessment are many, there are equally as many challenges associated with implementation. Some argue (Buhagiar, 2007) the use of alternative assessments have not gained widespread acceptance, commitment, or implementation from stakeholders. Others suggest (Anderson, 1998; Offerdahl & Tomanek, 2007) that efforts to incorporate alternative assessments are hindered by current attitudes, beliefs, and perceptions about the role and purpose of

assessment in learning. Further, use of alternative assessments seems to challenge and interfere with the traditional role of teacher and student (Anderson 1998; Sparapani, 2000) forcing teachers to think differently about the learning objectives and strategies (Sparapani, 2000).

Other factors seems to challenge the implementation of alternative assessment including overall lack of learning environments conducive for implementation of alternative assessments (Buhagiar, 2007), additional instructional activities associated with implementation (Anderson, 1998; Corcoran et al., 2004; Ewing, 1998; Sparapani, 2000; Zeigler & Montplaisir, 2012), and a post-secondary faculty that may be largely unprepared and unable to accurately gauge student comprehension during the learning process (Offerdahl &Tomanek, 2011).

In addition to instructional challenges, students also experience challenges (Howes & Stevenson, 2013) and trepidation associated with the introduction of creative and alternative forms of assessment (Purnell, 1999) and may require additional instruction to help them meet the challenges associated with alternative assessments (Zeigler & Montplaisir, 2012). Toth (2013) suggests that students are generally unprepared for the depth and extent of effort associated with creating infographics, thus contributing to additional instructional responsibilities of teachers (Anderson, 1998; Corcoran et al., 2004; Ewing, 1998; Sparapani, 2000; Zeigler & Montplaisir, 2012).

Need for Infographics Research

Extant literature on the subjects of alternative assessment and infographics prescribe a need to explore alternative visual approaches to instruction (Gallicano et al., 2014) and examine assessments that improve learning in post-secondary education by

empowering students with ways to demonstrate learning in new and non-traditional ways (Sanders, 2001). Further exploration is warranted into the use and perceptions of infographics in educational settings (Howes & Stevenson, 2013; Gallicano, et al., 2014) and how these alternative assessments meet the needs of different learners (Purnell, 1999), engaging both next generation (Lamb & Johnson, 2014b) and non-traditional learners (Hay, et al., 2010).

There remains a paucity of knowledge and little being done regarding the development of instructional environments conducive for and supportive of productive application of alternative assessments (Buhagiar, 2007) such as infographics in educational pedagogy (Howes & Stevenson, 2013) and the application of visualization techniques to the learning process (Callow, 2005; Callow, 2006; Reyes, 2011; Rosier & Dyer, 2010; Search, 2009). The call has been made by researchers (Corcoran et al., 2004; Tepper, 2004) to explore and evaluate creative assessments for use in all types of classrooms, but according to Hay, et al. (2010) evaluation in higher education classrooms is particularly warranted.

Some argue (Brown, 2014; Cano, 2011) for additional training and practice involving visual communication of information. This need for training extends to teachers, who could benefit from exploration of alternative assessment as part of teacher preparatory and training programs (Allen & Flippo, 2002). Training and development of visual literacy and visual thinking skills may help students cope with challenges in the learning environment (Brown, 2014; Daniel & Parada, 2009; Rezabeck, 2005) and address the need for new learning, evaluation, and support approaches (Alshatti, et al., 2010; McMacken & Witherell, 2005) providing educational opportunities and

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perspectives not previously utilized (Callow, 2006; Search, 2009). Although enhancements to learning performance have been shown to be positively affected by incorporating graphics into the instructional process (Lai & Newby, 2012), there is currently no targeted instruction regarding visual literacy and no prescribed method or strategy for teaching visual literacy skills (Yenawine, 1997).

Lack of research into post-secondary application of infographics provides opportunity for this study and advances the research into post-secondary educational utilization of an alternative, visual, infographic-based teaching and learning strategy. Further study into how infographics strategies impact specific learning contexts appear warranted and could contribute to the advancement of infographics research. Extant research identifies current utilization of various visualization tools in educational settings but falls short of quantifying the post-secondary educational application of infographics. Infographics lack the formal research necessary to develop educational best practices and implementation in post-secondary learning environments.

A pedagogical model for implementing an infographics educational and assessment strategy could help meet post-secondary educational needs. However, examples of training models and programs for infographics in post-secondary contexts are limited. Also limited are prescriptive conditions for utilizing infographics strategies in post-secondary learning environments. Lacking is information regarding optimum learning environment conditions, and teacher perceptions regarding usage of infographics, and factors influencing implementation of infographics strategies in post-secondary educational environments.

Conceptual Framework

The conceptual framework and lens for this research on infographics extends and expands on extant alternative assessment, visualization, graphic organizer, and drawing research by studying the use of a specific visual thinking, learning, and alternative assessment strategy – infographics in a post-secondary learning environment. This study seeks to explore the theoretical and practical applications of infographics from a post-secondary teaching, learning, and assessment perspective. Infographics are a form of visual thinking and learning and this study will therefore be informed and influenced by visual literacy theory and the application of compound visual thinking and visual learning strategies to frame and scaffold the relationship between theoretical visual thinking constructs and the practical application of infographics as an alternative assessment option in the post-secondary context. In addition, this study will be informed by the concepts associated with incorporating alternative assessments into the learning process.

Purpose of the Study

The purpose of this qualitative study is to explore the phenomenon of infographics in a post-secondary learning environment to determine the perceived impacts, influences, and contributions of infographics to the educational and assessment process and to develop a research-based model for educational application and teacher training. It is anticipated that implementation of infographics strategies will positively influence instructional design considerations, enhance teacher perceptions regarding alternative assessments, and provide prescriptive conditions for employing infographics as alternative assessment. This research seeks to explore the experiences, perceptions, and characteristics of post-secondary teachers exposed to infographics concepts

identifying factors that promote or inhibit pedagogical application of infographics as a learning and alternative assessment strategy. Outcomes of this research could address identified research needs, expand existing research, and could significantly influence how infographics and other visual thinking strategies and practices are integrated into the post-secondary learning context potentially altering current instructional design and pedagogical assessment approaches.

Research Questions

1. How do post-secondary teachers perceive, make sense of, and understand the infographics training experience?

    a. How can infographics be utilized in post-secondary educational contexts?

2. What do post-secondary teachers perceive to be factors that facilitate and barriers that impede the use of infographics as a form of alternative assessment in post-secondary learning environments?

    a. What constitutes an educational environment that is conducive for and supportive of infographic application in post-secondary educational contexts?

3. What do post-secondary teachers perceive to be the skills development, training, and support needs associated with implementation of infographic-based assessments?

Significance of the Study

The study is significant in several areas related to infographics research. (1) Research into the specific application of infographics as a post-secondary learning and alternative assessment strategy is negligible; (2) little is known about post-secondary

teacher perceptions involving use of infographics as an alternative assessment strategy;

(3) more study is needed exploring factors influencing the optimum learning environment

conditions for incorporating infographics-based assessments in post-secondary contexts;

(4) knowledge gained from this study provides a model for incorporating infographics

into post-secondary learning environments; (5) study findings provide insight into

infographics skill development and pre-requisite training requirements and implications;

(6) this study expands the research relating to post-secondary educational benefits and

challenges associated with a specific form of alternative assessment; (7) this study

provides insight into use of infographics across multiple post-secondary academic

disciplines and across different instructional delivery modalities.

Definition of Key Terms

This study seeks to ascertain the perceived impacts and benefits of infographics to

the post-secondary learning environment. The following concepts and terms are defined

in order to clarify their utilization within the study.

Alternative Assessment – According to Berry (2008) a form of assessment

"designed to stimulate students' abilities to create and apply a wide range of knowledge

rather than simply engage in acts of memorization and basic skill development" (p.81).

Drawing – Hanks and Belliston (1977) describe drawing as "a means of more

effective communication, understanding, expression, and enjoyment" (p.2).

Infographics – visual representations of data (Moorefield-Lang, 2011);

Purposeful, contextual, and persuasive combinations of text and visual elements arranged

and designed to tell a visual story (Toth, 2013).

Sketchnotes – Rohde (2013) describes sketchnotes as visual displays of meaningful thought that are constructed from the combined processes of seeing, hearing, and thinking.

Visualization - confluence of thinking, understanding, and communication involving a process of externalizing the thoughts and ideas of the mind (Hanks & Belliston, 1977) matching and mapping internal conceptions to an external visual format informed by existing knowledge and thought processes (Ziemkiewicz &Kosara, 2009).

Visual learning – using imagery and graphics to understand, interpret and convey information (Chmela-Jones, Buys, & Gaede, 2007).

Visual literacy – "The ability to read and interpret visual images" (Vasquez, Troutman, Comer, & National Science Teachers, 2010, p.xi).

Visual thinking – a process of seeing, imagining, and developing visual representations (McKim, 1980; Roam, 2009).

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

A literature review of infographics concepts was conducted to determine the

status of research on this emergent phenomenon. The literature review seeks to establish

the relationship of alternative, creative assessments and infographics to the improvement

of teaching, learning, and assessment in post-secondary educational settings. The

conceptual framework (Figure 1) and lens for reviewing literature on infographics

therefore focuses on the major themes of alternative assessments, information

visualization, and visual thinking and learning constructs. These major themes provide

the necessary context to inform the research questions of this study. Each section in the

review addresses a major theme relating to the use of infographics as an alternative form
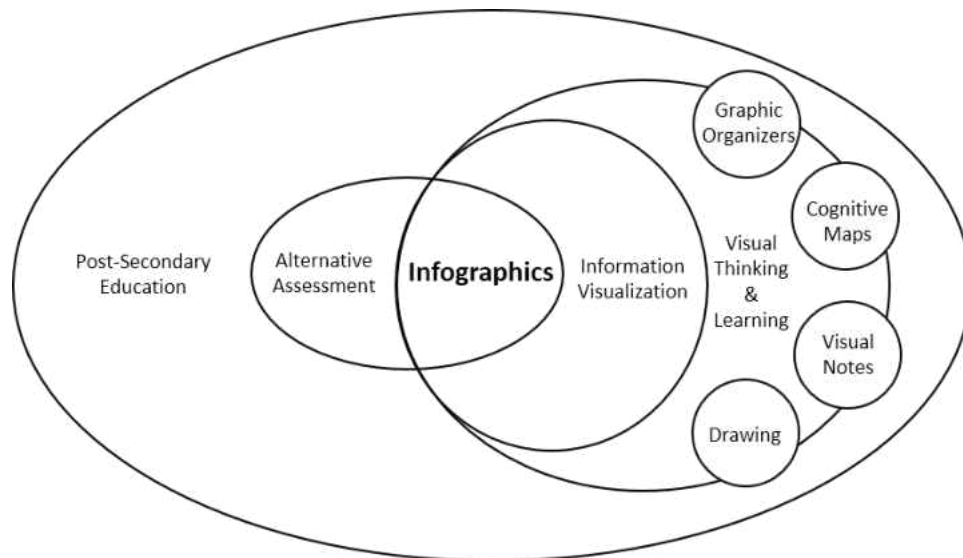
of assessment.

Figure 1. Conceptual framework. Infographics are a form of alternative assessment based
on the concepts of information visualization; Information visualization is influenced by
visual thinking and learning concepts. The use of infographics is studied in the post-
secondary educational context.

This conceptual framework informs and guides the review of the literature exploring key concepts and themes related to the use of infographics as alternative assessment. Literature related to the use of alternative assessment is explored to evaluate current post-secondary educational environments and the current use and need for forms of alternative assessment. The literature reviewed builds a foundation necessary for understanding a specific form of alternative assessment – infographics. To build this foundation several themes emerge.

The first theme, alternative assessment explores the current utilization of alternative assessment in educational settings, provides a description of alternative assessment, reviews existing alternative assessment research, describes alternative assessment problems and deficiencies, and identifies the need for additional alternative assessment research. Infographic assignments can be a form of alternative assessment and a review of the literature regarding alternative assessment research is necessary to provide a context for this form of creative, alternative assessment.

The second theme, infographics as an information visualization and assessment strategy, explores current research into the use of infographics identifying skills associated with this form of information visualization, potential educational benefits, and challenges associated with utilization and implementation. The concepts associated with infographics converge from the constructs of alternative assessment, visual thinking, visual learning, and visualization.

The third theme, visual thinking and visual learning as a learning strategy, explores the foundations of visual thinking and learning, provides a description and overview of visualization topics, identifies research related to visual thinking and

learning, and explores and categorizes visual thinking and visual learning strategies. An overview of visual thinking and learning establishes a foundation and context for the use of visualization tools in education providing insight into how visual formats such as infographics are categorized and utilized in learning. Specific visual thinking and learning concepts are explored including graphic organizers, cognitive mapping, graphic facilitation, visual note taking, and drawing. Infographic activities incorporate graphical elements similar to those utilized in the aforementioned forms of visual thinking and learning and a review of research regarding the use of these constructs helps provide insight into how graphics-based instructional and assessment tools such as infographics might be used in the classroom.

The fourth theme, implementing alternative assessments, explores both alternative assessment and infographics research synthesizing suggestions and recommendations on how to design alternative assessments, implement, and evaluate infographic-based alternative assessments. This section informs the development of the infographics training program to be utilized in this study.

The literature review includes information from multiple and diverse sources including peer-reviewed academic journals, books, periodicals, conference presentations, and conference proceedings retrieved utilizing electronic databases, print, and online sources. Gaps and voids in the research are identified within each section and included in an overall summarization of infographics research needs.

Alternative and Creative Assessments

According to Berry (2008) alternative assessment is a form of assessment "designed to stimulate students' abilities to create and apply a wide range of knowledge

rather than simply engage in acts of memorization and basic skill development" (p.81).

Extant literature reviewed exploring the use of alternative and/or creative forms of

assessment can be divided into the following sub-topics or categories (1) the need for

alternative assessments, (2) the benefits associated with alternative assessments, (3) and

challenges associated with the use of alternative assessments.

Need for Alternative Assessment

The need for alternative assessment in post-secondary education is derived from

the current instructional and assessment environment's apparent failure to address

changes occurring in the post-secondary learning environment. Despite the need to

address changing student demographics (Hay, et al., 2010) and changing post-secondary

learning processes (Anderson, 1998), the lecture format of instruction (Anderson, 1998;

Gur, et al., 2013; Kiewra, 2002) and traditional, objective-based assessment approaches

retain their dominance and pervasiveness (Anderson, 1998). As a result, some argue

(Sanders, 2001; Taras, 2002) that critical, higher-order thinking is not being promoted in

higher education classrooms.

To complicate matters, post-secondary institutions seem reliant on traditional

forms of assessment that do little to inform educational strategies. Torrance (2007) fears

that the focus and emphasis post-secondary institutions place on the attainment of

learning outcomes has supplanted the need to measure the overall student learning and

development, a move which negatively impacts educational value and worth. Taras

(2002) agrees and adds that universities are failing to develop learners who can think on

their own focusing on increased reliance on assessment and less emphasis on improving

learning. Taras adds that higher education students are unsatisfied with educational

strategies primarily influenced by the propensity to use traditional summative assessments.

Some of this reliance on traditional forms of assessment may be linked to how instructors view the role of assessment. Buhagiar (2007) observes that although assessment is central to the learning process, use of assessment for learning has gravitated away from an emphasis on learning toward more traditional summative purposes. Herman (1992) and Sanders (2001) similarly argue that assessments used in higher education fail to capture and inform the learning process. Offerdahl and Tomanek (2011) found that higher education instructors viewed assessment as primarily a tool to determine achievement of an educational outcome and not something that could be utilized to influence learning. In addition, Britton (2011) suggests that this reliance on summative assessments as the sole assessment measure may be resultant of teachers failing to embrace formative assessment opportunities. Buhagiar (2007) finds that although summative assessment remains necessary, the use of formative assessment can be used as a means to gauge the status of learning and as an influencer to the teaching and learning process.

There is also evidence to suggest that sustained reliance and continued utilization of traditional forms of assessment in post-secondary education may be inhibiting and adversely influencing (Buhagiar, 2007) and falling short of quantifying and comprehensively measuring student learning (Drake, 2001; MacKenzie & Zinn, 2008). Further, traditional forms of assessment appear to be failing to engage students in learning (Drake, 2001) precluding substantive student involvement in the assessment process (Taras, 2002).

There appears to be a need to evaluate current teaching and assessment practices and consider new approaches to assessing student learning (Sanders, 2001; Tepper, 2004) moving away from traditional, objective-based assessments toward more alternative assessment techniques (Anderson, 1998). Tepper (2004) suggests that creative and alternative assessments should be evaluated for use in all types of classrooms arguing that creative assessments benefit the learner in many ways. Anderson (1998) describes a need in higher education to move from traditional, objective-based assessments to more alternative assessment techniques. Utilizing these alternative assessment techniques to meet the changing needs of students (Hay, et al., 2010). Alternative forms of assessments appear to address some of the deficiencies associated with traditional assessment techniques and provide a comprehensive measure of learning (Drake, 2001). Mullen (2011) suggests that educational leaders encourage and support learner creativity by balancing traditional forms of assessment with a diversity of authentic, alternative forms of assessment. Shepard (1989) also suggests that students be evaluated with multiple forms of assessment. The utilization of multiple forms of assessment may be necessary to overcome deficiencies and shortcomings of individual assessment methods (Buhagiar, 2007; Shephard, 1989) and provide for a diversity of methods that reflect and exemplify the ongoing study of educational strategies (Valencia, 1990).

The literature suggests that alternative assessments promote and influence learning in ways not possible with traditional forms of assessment and as Buhagiar (2007) found, provides a means to improve learning beyond the summative function. As Anderson (1998) observed, there are fundamental differences between traditional and alternative assessments regarding the roles of the learner, roles of the group, and the

influences to the learning process. Alternative assessments provide options for students to demonstrate understanding of concepts and provide a means to assess student understanding not typically demonstrated by traditional assessments (Britton, 2011; Drake, 2001; MacKenzie & Zinn, 2008; Sanders, 2001). Maclellan (2004) adds that these alternative approaches to assessment are a departure from traditional assessment techniques utilizing processes that incorporate the learning needs, experiences, and judgments of the individual learner developing what Ewing (1998) describes as a broader view of learning. Further, Purnell (1999) observed that the nature of creative alternative assessment allows for thoughtful manifestation of the learning process, capturing learning and imaginative thought in ways that are different and more meaningful than traditional forms of assessment. Sanders (2001) adds that alternative assessments can infuse more variety into the learning process engaging learners in ways not occurring with traditional assessment practices and as some suggest (Drake, 2001) provides learners with new options for communicating and presenting what has been learned. In the context of an infographic, this form of alternative assessment provides learners with opportunities to visually share understanding with others (Moorefield-Lang, 2011).

Benefits of Alternative Assessment

The literature involving the use of alternative assessments reveals significant instructional benefits. The use of alternative assessment practices contribute to greater levels of understanding (Allen & Flippo, 2002; Anderson, 1998; Drake, 2001; Purnell, 1999; Tepper, 2004), promotes student engagement and involvement (Allen & Flippo, 2002; Corcoran, et al., 2004; Sanders, 2001; Sparapani, 2000; Tepper, 2004), stimulates excitement and interest for learning (Purnell, 1999; Tepper, 2004), and provides for

flexibility in demonstration of learning (Sparapani, 2000; Tepper, 2004). Further, alternative assessments provide students with progress information (Offerdahl & Tomanek, 2011), promoting autonomous, self-directed learning, and freedom in the development of self-directed learning pathways (Allen & Flippo, 2002; Anderson, 1998; Sparapani, 2000). This student-centric approach to learning (Offerdahl & Tomanek, 2011) is valued and appreciated by students (Allen & Flippo, 2002; Purnell, 1999) and meet the needs of different learners (Purnell, 1999).

In addition to specific learner benefits, use of alternative assessments seems to significantly benefit the learning environment. Alternative assessments help to establish a holistic, connected approach to teaching and learning (Anderson, 1998) that is inclusive of and supports multiple intelligences (Corcoran et al., 2004), developing learning environments that promote critical thinking and sense-making (Drake, 2001), encourage student creativity (Purnell, 1999; Sparapani, 2000), and stimulate imaginative, collaborative, and meaningful learning (Purnell, 1999).

Challenges Associated with Alternative Assessment

Review of alternative assessment literature suggests an opportunity for significant educational benefits but reveals challenges associated with usage. Buhagiar (2007) argues that despite benefits espoused regarding the influence of alternative assessments to the learning process, alternative assessments have not gained widespread acceptance or commitment from stakeholders in the learning process. The literature suggests that views on the role of assessment in the learning process are changing and that implementation of alternative assessment strategies have been hindered by current attitudes, beliefs, and perceptions about the role and purpose of assessment in learning (Anderson, 1998;

Buhagiar, 2007; Offerdahl & Tomanek, 2007). Anderson (1998) suggests that the use of alternative assessments challenge traditional assessment approaches directly influencing the traditional role of student and teacher, impacts instructional approaches, and affects the process and role of evaluation in the knowledge construction process. Sparapani (2000) seems to agree finding that the traditional role of the teacher changes to more a facilitative and supportive role as a result of implementing alternative teaching strategies. Anderson (1998) and Corcoran et al., (2004) suggest that implementation of alternative assessment practices can be challenging finding that many teachers struggle with implementation of alternative assessments. Allen and Flippo (2002) agree and recommend caution regarding implementation. Offerdahl and Tomanek (2011) suggest that many higher education teachers are unprepared and largely unable to accurately gauge student comprehension and learning during the instructional process. Further, Sparapani (2000) submits that alternative assessments require the instructor to think differently about the learning objectives and the learning strategies to be employed.

Many of these instructional challenges stem from the extra time involved, additional instruction time needed, and issues surrounding the learning environment. Challenges involving the time necessary to implement an alternative assessment approach are pervasive in the literature. Sparapani (2000) found that instructors incorporating activities to promote higher-level thinking required more time to design the instructional activities and more time was necessary in class to implement the activities. Alternative assessment approaches require significant time for planning and design (Ewing, 1998; Sparapani, 2000), instruction related to the alternative assessment (Zeigler and Montplaisir, 2012), implementation of assessment (Ewing, 1998; Purnell, 1999;

Sparapani, 2000), student modification and revision based on feedback (Britton, 2011), and time for grading (Ewing, 1998).

The literature also suggests that students may need additional instructional support in classrooms implementing alternative assessments. Buhagiar (2007) laments that little has been done to establish learning environments conducive for the implementation of alternative assessments. As such, Purnell (1999) suggests that instructors be cognizant of student trepidation associated with the introduction of creative and alternative forms of assessment. Zeigler and Montplaisir (2012) observe that students may require additional instruction to help better prepare them to meet the challenges associated with forms of alternative assessment. In addition, Sparapani (2000) cautions that access to resources necessary to support higher-level thinking may be limited and this lack of or limited access to technological and support resources may impact implementation of learning activities promoting higher-level thinking.

In addition to the learning environment challenges associated with alternative assessment, the literature also reveals additional concerns. Given that alternative assessments are a departure from traditional assessment techniques and measure learning in different ways (Britton, 2011; Maclellan, 2004) some question and are concerned with the validation, generalization (Ewing, 1998; Herman, 1992) and subjective evaluation associated with alternative assessments (Drake, 2001).

Shepard (1989) suggests that students benefit from challenging and authentic learning strategies that empower them with opportunities to make sense of new material. Alternative assessment approaches may provide this opportunity. One such alternative assessment strategy might be the use of infographics. Literature involving the concept of

infographics was researched to develop understanding of this form of information

visualization and alternative assessment including historical origins of the concept,

definitions, skill development, benefits, and challenges associated by the concept of

infographics.

Brief History of Information Visualization

Using visuals and illustrations to convey information has long been part of human

history. Nearly 30,000 years ago, prehistoric life was visually depicted on cave walls

located in what is now France. Over 5,000 years ago, ancient Egyptians introduced and

utilized a visual form of communication known as hieroglyphics, which employed

graphical icons and symbols to convey information (Smiciklas, 2012; Virag, 2013). The

first known use of a graphic to explain a process was introduced in medieval times

around 1350 AD (Smiciklas, 2012). During the Renaissance, Leonardo da Vinci,

combined text and illustrations to create a comprehensive guide to human anatomy. Early

visualization pioneer and Scottish engineer, William Playfair, utilized visualizations in

1786 to convey information displaying numeric data visually utilizing various forms of

charts (Smiciklas, 2012; Virag, 2013). French engineer Charles Joseph Minard later

utilized the concept of using information visualization to represent complex combinations

involving multiple sources of data into a comprehensive information graphic (Smiciklas,

2012). In the mid-1800's Florence Nightingale effectively utilized visualization

techniques to inform decision making and policy regarding the need to improvements to

hospital conditions during the Crimean War (Virag, 2013). During the twentieth century

information visualization evolved as the use of isotype was introduced by Otto Neurath to

provide a means to communicate using simplified graphical presentations consisting of icons and imagery. (Smiciklas, 2012).

Use of information visualizations continues today and is apparent in popular media publications such as newspapers and magazines. Information graphics in this context are used to augment written text and to provide information in alternative form in an attempt to aid comprehension and understanding (Smiciklas, 2012). The pervasiveness of a specific form of information visualization known collectively as infographics are emerging in our digital society. The use of this form of information visualization has begun evolving from use in print media and has expanded into a variety of professional and social contexts (Toth, 2013).

Infographics Defined

Information graphics, or infographics, are visual representations of data (Moorefield-Lang, 2011) that creatively combine and arrange text and various graphical components to tell a visual story about a particular topic (Lamb & Johnson, 2014a; Toth, 2013; Virag, 2013) providing what Abilock and Williams (2014) suggest, as a "unique synthesis imaginatively presented" (p. 47). Through a process of inquiry and research, infographics are used to distill, refine, and communicate data (Abilock & Williams, 2014; Gallicano et al., 2014; Lamb & Johnson, 2014b) by accurately, visually, and creatively conveying and simplifying complex data to an understandable, compelling, and visually appealing form (Gallicano, et al., 2014). Further, infographics are utilized to support a perspective, encourage action (Gallicano et al., 2014), persuade an audience (Abilock & Williams, 2014; Toth, 2013), develop and support an argument, and to demonstrate understanding (Gallicano, et al., 2014; Abilock & Williams, 2014; Toth, 2013).

Abilock & Williams (2014) eloquently summarize the concept:

"An infographic is a claim expressed through visual metaphor, conveying the creator's fresh understanding of relationships, expressed through a judicious selection and arrangement of visuals, evidence, and text acquired during inquiry research within a discipline" (p. 47).

Gallicano et al. (2014) suggests that a well-designed infographic should accurately, visually, and creatively convey a supported perspective by refining or simplifying complex data to an understandable, compelling, and visually appealing form. According to Virag (2013), infographics fuse graphic design principles with information designed to promote clear and effortless comprehension of concepts.

Infographics come in a variety of formats. Figure 2 is an example of an infographic developed using computer applications.

Figure 2. Computer-generated infographic

Figure 3 provides an example of a sketch-based infographic. This study utilizes the sketched form of infographic design.
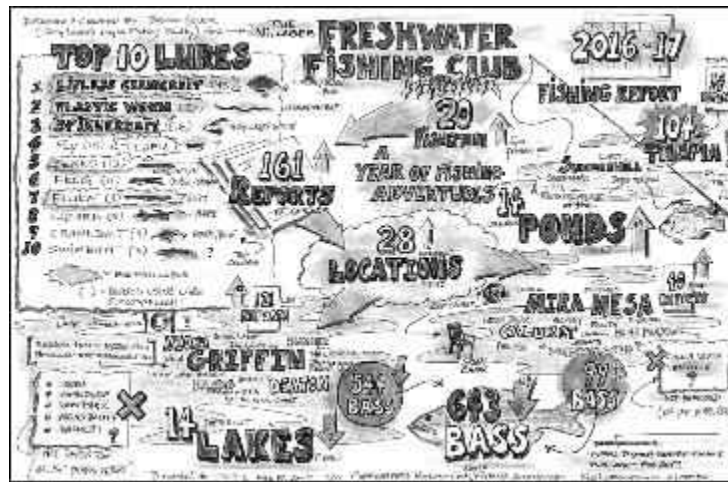
Figure 3. Sketch-based infographic

Sketch-based infographics can be utilized on their own or can be converted to a form similar to Figure x.x using computer applications.

Skills Developed with Infographics

Students acquire and cultivate a variety of skills and abilities when developing infographics (Davidson, 2014). According to Davidson (2014), the iterative infographic creation process engages and empowers students by encouraging critical evaluation, substantiation, and presentation of complex data supporting the development of skills associated with representational thought. Among these are skills in researching, identifying, and selecting sources of information (Davidson, 2014; Gallicano, et al., 2014; Howes & Stevenson, 2013; Lamb & Johnson, 2014a; Toth, 2013), critically evaluating, analyzing, and assessing the credibility of that information (Lamb & Johnson, 2014b; Toth, 2013) and skills selecting the most appropriate information for use in the infographic (Davidson, 2014). In addition, learners develop skills and abilities necessary

for inquiry (Abilock & Williams, 2014; Lamb & Johnson, 2014a), develop skills critically exploring and understanding a topic (Howes & Stevenson, 2013; Virag, 2013; Zuk, 2011) and develop skills and abilities related to conveying and synthesizing information visually (Davidson, 2014; Gallicano, et al., 2014). Infographic assignments also help to augment and support students' writing ability (Gallicano, et al., 2014), develop skills and abilities associated with technology used to create infographics (Davidson, 2014; Lamb & Johnson, 2014b), develop skills in communicating visually (Davidson, 2014; Moorfield-Lang, 2011), and develop essential skills that can be applied in a variety of situations (Lamb & Johnson, 2014b). The learning experience associated with developing infographics is summarized by Abilock and Williams (2014) as follows:

> Not only will students experience a discovery process and acquire disciplinary knowledge, but they will also analyze different options, construct a logical argument, reason through examples and analogies using multiple literacies, and learn that complex problems have qualified solutions from which new questions naturally arise. (p. 47)

Benefits of Infographics

A review of literature relating to the benefits of infographics are varied and numerous indicating that infographics provide a diverse influence to the learner and the learning process. In addition, infographic assignments benefit the instructional process and provide opportunities for learners. Infographic assignments benefit the learning process (Howes & Stevenson, 2013; Virag, 2013; Zuk, 2011), by encouraging analytical thought (Virag, 2013) and by providing opportunities for demonstrating student learning (Abilock & Williams, 2014). Creation of infographics influences learner creativity

(Howes & Stevenson, 2013; Moorefield-Lang, 2011), promotes autonomy (Howes &

Stevenson, 2013; Toth, 2013) and facilitates unrestricted thoughtful exploration (Abilock

& Williams, 2014; Howes & Stevenson, 2013). Toth (2013) finds that students enjoy

experiencing the self-directedness and autonomy of the infographic assignment and that

the infographic development process helped to develop a greater understanding about the

course content while encouraging more connectivity to the learning process. To support

Toth's finding, Howes and Stevenson (2013) and Simiklas (2012) agree that in order to

develop and design an infographic, students must fully understand the topic, problem, or

issue before they are able to creatively and visually communicate this understanding.

Howes and Stevenson (2013) suggest that the infographic assignment helps to promote a

more thorough understanding of content by fostering creativity and affording autonomy.

Gallicano, et al., (2014) suggests that in addition to communicating information,

infographic assignments provide opportunity to gain insight from how the creators of the

infographic perceive a topic or issue. In addition to these benefits it has been found that

learners enjoy creating infographics and as a result, are immersed and involved in the

process (Toth, 2013). Infographics assignments help to prompt discussion (Lamb &

Johnson, 2014b) by engaging, involving, and capturing the attention of learners

(Davidson, 2014; Gallicano, et al., 2014; Toth, 2013) in a process that is perceived as

worthwhile and valuable (Howes & Stevenson, 2013). Moorefield-Lang (2011) suggests

that infographics provide learners with an opportunity to visually share their

understanding with others.

Challenges Associated with Infographics

Although the benefits of infographics are numerous, instructors considering use of infographics as an alternative assessment or assignment should be aware and cognizant of challenges associated with infographic assignments. Howes and Stevenson (2013) and Lamb and Johnson (2014a) acknowledge the alternative and different nature of the infographic assignment created challenges and difficulties for students. Toth (2013) found that students were unprepared for the depth and extent of effort needed to create infographics suggesting that one of the most difficult aspects of creating an infographic is condensing and organizing a large amount of data into a convincing, purposeful, visual representation. Toth also found that students struggled with visual design elements. Building on Toth's (2013) observation relating to student difficulties condensing and organizing large amounts of information, Cano (2011) suggests that it is possible to overwhelm an audience with too much information and adds that improper use of visual displays of information may lead to misinformation and confusion, obstructing the purpose of the message (Cano, 2011) or misrepresenting the meaning of the information (Moorefield-Lang, 2011). Howes and Stevenson, (2013) and Toth (2013) suggest that these challenges are complicated by time constraints associated with the infographic assignment. Howes and Stevenson (2013) found that constraints associated by the time allocated for infographic design should be carefully considered and monitored in order to facilitate the creativity aspects of the infographic design.

Research into infographics as a form of alternative assessment is informed by several emerging learning practices that incorporate visual thinking and visual learning strategies. These related concepts are built upon the underlying constructs of visual

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thinking and visual learning and include graphic organizers, cognitive mapping, graphic facilitation, visual note taking, and drawing.

Visual Thinking and Visual Learning Strategies

This section provides an overview of visual thinking and learning, describing the foundations of visual thinking and learning, the perceived benefits of visual thinking, the influences of visual literacy, the taxonomy of visualization methods, and visual thinking methods that converge to influence infographics.

The landscape of visual thinking literature is sprawling and varied, drawing from diverse sources including business and industry, marketing, healthcare, visual arts, education, sciences, engineering, design, information technology, and computer graphics. The review paints a broad picture of the visual thinking field and although the literature area appears populated with a plethora of visual-thinking tools there appears to be little extant research related to the application of visual tools to the post-secondary teaching and learning process.

To establish the context of infographics within the paradigm of visualization it is necessary to first define visual thinking, visual learning, and visualization. Visual thinking is the transformation, manipulation, and modification of information resultant from the processes of seeing, imagining, and developing visual representations (McKim, 1980). Visual learning is using imagery and graphics to understand, interpret and convey information (Chmela-Jones, et al., 2007). Visualization is the confluence of thinking, understanding, and communication involving a process of externalizing the thoughts and ideas of the mind (Hanks & Belliston, 1977) matching and mapping internal conceptions to an external visual format informed by existing knowledge and thought processes

(Ziemkiewicz & Kosara, 2009). Visualization is based on the principles of reduction and space involved with structuring and organization of information (Manovich, 2011) and can provide new pathways to address complex, dynamic, multi-partite, and difficult decision-making situations including a variety of domains (Smithin, 1980).

Visual thinking is not a new concept. The foundations of information visualization can be traced to the eighteenth century (Manovich, 2011). Much of what is referred to as visual thinking today is resultant from the seminal research of Rudolph Arnheim (1969) in his groundbreaking book – *Visual Thinking*. Arnheim's significant contributions to the field of visual thinking resonate in many of the contemporary visual thinking applications. Arnheim (1980) believed our innate abilities to link our senses with our cognitive processes had been eroded over time and that it was necessary to reestablish this important cognitive link and proposed that visual thinking can reform these lost connections and remove barriers to the thought process.

Although much of the formative thought surrounding visual thinking occurred several decades ago, there appears to be resurgence of interest in the concept. Building on Arnheim's earlier contributions to visual thinking, contemporary visual thinking practitioners continue to influence, shape, and classify visual thinking. Examples of these efforts include, the classification of visualization techniques developed by Lengler and Eppler (2007), the visual thinking model developed by Roam (2008) and the visual thinking taxonomy described and developed by Sibbett (2010). However, research regarding the effectiveness of visualization techniques is sparse (Rosier & Dyer, 2010) relying predominantly on anecdotal accounts and testimonies (Lurie & Mason, 2007) creating an amorphous, fragmented domain of visualization (Lengler & Eppler, 2007). It

appears that the field of visualization needs empirical, evidence-based research to solidify its potential for educational application.

Visual thinking and visual thinking methodologies benefit teaching, learning, and assessment. Visual thinking and visual interpretations of content can promote thinking, learning, and creativity (Ntuen, et al., 2010; Rezabek, 2005) contributing to better learning, greater understanding, and improved retention of information (Davies, 2011; Long & Carlson, 2011; Ntuen, et al., 2010; Rozalski, 2008). Visualization of information positively affects mental model construction (Schnotz & Kürschner, 2008; Gooding, 2004), by promoting theoretical understanding (Ntuen, et al., 2010), and facilitating the exploration, discovery, and pattern recognition within information (Offenhuber, 2010). Visual representations can also be used to assess learning, provide deeper understanding about the learning process, provide an outlet for displaying student thinking, and a method for comparing different perspectives and interpretations of an issue (Naykii & Jarvela, 2008). To further understand how visual thinking and visualization can impact the teaching and learning process it is necessary to explore the underlying theory influencing and supporting visual thinking.

Visual Literacy Theory

Visual literacy is the ability to match visual constructs to the appropriate context for the purpose of developing cognitive, creative and communicative processes and abilities (Brown, 2014). The somewhat nebulous and elusive concept of visual literacy forms the foundation for visual thinking, visual learning, and visualization. Infographics, like other visual thinking methods seems based upon the tenets of visual literacy theory. The dynamic concept of visual literacy continues to evolve with little agreement on the

exact definition and description. Visualization is an emerging field in terms of application (Wang & Jacobson, 2011) and although there is an apparent increased attention in the application of visualization theories, there is also associated dissention in the underlying theoretical foundations supporting visual thinking (Ziemkiewicz & Kosara, 2009). The theoretical constructs supporting visual thinking seem mired in contention among visual literacy proponents. Even the definition of visual literacy is tenuous. Brill, Dohun, and Branch (2007) explored the apparent lack of consensus and the contested definitions of visual literacy and usage of visual language proposing a visual language, grammar, and mutual taxonomy but highlight the need for establishing standardization to further advance the field. The lack of standardization in the field suggests development along a wide range of topics and utilization approaches. Argerinou and Pettersson (2011) also describe the overall lack of uniformity in the field of visual literacy and lack of scholarly agreement on establishment of foundations for the visual literacy field and proposed their own construction of theoretical components including the concepts of visual perception, language, learning, thinking, and communication.

The overall inconsistency in the description and form of visual literacy makes it difficult to evaluate the commonality and purposes of different applications of visual literacy. The lack of visual literacy and inability to employ visual forms of language negatively impacts the ability to engage and enlist our inherent cognitive capabilities resulting in adverse performance consequences (Brown, 2014).

The foundations of visual literacy inform and shape visual thinking strategies and techniques by establishing the building blocks necessary to develop visual thinking

applications designed for learning environments. Infographics are influenced by several existing visual thinking strategies and information visualization techniques.

Visual Thinking and Information Visualization

The phenomenon of visual thinking and information visualization has many different interpretations and meanings (Sibbett, 2013). For this discussion it is important to categorize and classify visual thinking strategies and techniques. The classification of visual thinking strategies and techniques assists in the categorical and contextual placement of infographics. This categorization is important for establishing connections, interactions, and associations with other visual thinking techniques. Based on the review of the literature there are a variety of visual thinking strategies and techniques in use and two major frameworks for classifying visual thinking paradigms and an additional model proffered (Roam, 2008) for classifying visual thinking processes.

The first classification model is Lengler and Eppler's (2007) *Periodic Table of Visualization Methods* which provides a conceptual framework for classifying visual thinking methodologies and practices categorized by the type of visualization task. These categories include visualization of data, information, concepts, strategy, metaphor, and compound visualizations. Lengler and Eppler's framework provides an overview of visualization tools and methods establishing different levels of detail and complexity and classifying visualization methods based on specific application and type of thinking promoted. The second major classification model is the Lindquist/Sibbett model (Sibbett, 2013), which identifies characteristics and components of visualization methods within the four major categories including visual facilitation, data visualization, graphic design, and cognitive visualizations. These major categories of visualization are further

classified within the context of information design, information visualization, design thinking, and information architecture.

The two visualization frameworks share characteristics. The Lengler and Eppler (2007) model and the Lindquist/Sibbett (2013) model of visualization practices and methods share the visualization categories of data and information visualization. In addition, Lengler and Eppler's concept visualization and metaphor visualization categories correspond to Sibbett's cognitive visualization and information design categories. Lengler and Eppler's category of compound visualization is similar to Sibbett's category of visual facilitation. These important categorical similarities provide the contextual placement for infographics. The compound visualization category described by Lengler and Eppler (2007) and the cognitive visualization and visual facilitation categories (Sibbett, 2013) appear to provide the appropriate classification for infographics. Compound visualizations as the name implies are combinations of other visualization methods including concept visualization, information visualization, and metaphor visualization. Compound visualizations are the most complex of the visualization categories and include graphic facilitation, cartoons, rich pictures, knowledge maps, learning maps, and infomurals (Lengler & Eppler, 2007). Similarly, the cognitive visualization and visual facilitation categories described by Sibbett (2013) encompass such things as mental models, metaphor, frames of reference, visualization practice, graphic recording, and graphic facilitation and represent combinations of other visualization practices. The resultant synthesis of both models appears to frame the categorical boundaries for the evolution and establishment of infographics as a compound visual thinking methodology and practice.

A third model of visual thinking is applicable to this review. Roam's (2008) visual thinking model focuses on visual thinking processes instead of categorization of visualization methods. Roam's four-step visual thinking model describes the actions of looking, seeing, imagining, and showing. These four processes are used to collect and screen information, select and group information, manipulate the information based on existing knowledge, and provide a mechanism for communicating the information in a way that is understandable. The combination of these three models is significant in that it provides a framework for classifying infographics and positions infographics within the visual thinking and visual learning constructs.

Visual Thinking Methods

For the purposes of this discussion, the visual thinking methods reviewed are limited to those forms of visual thinking which are fundamental to the construction of compound visual constructs such as infographics. The visual thinking methods that meet this criterion include graphic organizers, cognitive mapping techniques, graphic facilitation, drawing, and visual note taking applications.

Graphical organizers. Graphic organizers (GOs) are two-dimensional visual displays of concepts that represent and identify relationships utilizing spatial formatting, placement, and orientation of text (Katayama & Robinson, 2000). GOs incorporate graphics and visuals to illustrate and make sense of text-based content (Barrett-Mynes, Moran, & Tegano, 2010). Graphical organizers evolved from the concept of advance organizers. Advance organizers were found to improve the comprehension and recall of verbal material (Ausubel, 1960) and as graphic organizers developed their effectiveness to student performance has persisted (Robinson & Kiewra, 1995).

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GOs and infographics strategies are similar in the utilization of graphics, text, and spatial formatting. The similarities and properties shared between the GOs and infographics are significant to this discussion. GOs are included in this review because of their proven effectiveness as a graphics-based learning tool and because of their similarity to processes and structures utilized in infographics.

To understand the effectiveness of GOs it is important to explore how and why they work. GOs are utilized as a learning strategy to describe relationships between important concepts by focusing on major ideas and relationships between the concepts and ideas (Hoffman, 2003; Porcaro, 2012, Reyes, 2011). Ausubel and Fitzgerald (1962) surmised that new learning is a variation of existing knowledge. Ausubel and Fitzgerald found that organizers could augment and support this process. GOs provide learners with a framework for developing new learning by providing an organizational and structural format for analyzing content, identifying essential information, and relating concepts (Zoliman, 2012).

GOs are effective learning formats for representing current knowledge, gaps in knowledge, and knowledge gains by converting words to pictures and abstract concepts into meaningful information (Alshatti, et al., 2010; Hall, et al., 2013). The use of graphical information, spatial relationships, and visual formatting in a GO helps to attract, focus, and stimulate interest to the issue being studied and contributes to learning (Porcaro, 2012; Robinson & Kiewra, 1995). The graphical format of a GO helps to scaffold and frame thought, promotes the holistic assessment and comprehension of content (Barrett-Mynes, et al., 2010; Daniel & Parada, 2009; Ermis, 2008; Reyes, 2011).

GOs have been extensively studied and found to contribute to learning outcomes of significance to infographics research. A review of these outcomes yields an underlying and central theme of particular importance to research regarding infographics. GOs help to increase comprehension and understanding of complex information by structuring and organizing information into meaningful patterns and by identifying relationships and connections within information (Katayama & Robinson, 2000; Porcaro, 2012). GOs also kindle and promote critical thinking skills (Alshatti, et al., 2010; Porcaro, 2012), and enhance development of problem-solving skills and abilities (Zoliman, 2012; Alshatti, et al., 2010). GOs help to facilitate the identification of main concepts and ideas (Daniel & Parada, 2009; Hoffman, 2003), support the generation of meaning (Katayama & Robinson, 2000) and establish the context of a particular issue or topic (Barrett-Mynes, et al., 2010). GOs encourage generative processing (Stull & Meyer, 2007), promote collaboration (Barrett-Mynes, et al., 2010), and stimulate the application and communication of knowledge (Robinson & Kiewra, 1995; Zoliman, 2012).

Robinson and Kiewra (1995) describe a need by educators to identify ways to assist students with learning, recalling, and applying new concepts. GOs have been shown to meet this need. However, in order to meet the demands of current and emerging educational environments, students must be taught new ways to develop and expand their knowledge, skills, and abilities (Sundeen, 2007). There continues to be an ongoing need to identify and evaluate current student knowledge and to prescribe targeted and specific instruction to meet the learning needs of students (McMackin & Witherell, 2005) and to develop learning environments that promote and cultivate student thinking (Ritchhart, Turner, & Hadar, 2009). GOs provide platforms for altering learning approaches and

content to meet the learner need (Struble, 2007) and facilitate alternative approaches to learning that engage the student (Ermis, 2008).

Although GOs have been extensively studied, learning environment and training considerations remain a research need for GOs. Alshatti, et al., (2010) suggest that GOs represent a new paradigm for engaging the learning process but caution that the effectiveness of GOs is dependent on the learning environment in which they are employed and the potential of the teacher to creatively alter that learning environment. Additional training is needed in order to prepare students and teachers to effectively utilize GOs (Daniel & Parada, 2009, Harris & Zha, 2013; Reyes, 2011,) without introducing excessive cognitive load (Stull & Mayer, 2007).

An opportunity exists for educators and the research community to explore the use of visual frameworks that promote the analysis, synthesis, and relation of information (Reyes, 2011) expanding upon the extant research of GOs. Li (2008) recommends that learners be encouraged to develop their own visual structures and arrangements of conceptual information in order to present the information in a form that is understandable, meaningful, and memorable. Infographics may be the synthesis and application of a GO form that can positively impact the learning environment as described by Dexter and Hughes (2011). The impact of GOs to the learning process is established and significant but perhaps there is a way to further expand their capabilities utilizing visual thinking and visual learning strategies.

Cognitive mapping. The purpose and benefits of graphic organizers (GOs) in terms of their importance to this study have been previously discussed. Expanding on that initial discussion, this section will focus on a GO subtype commonly known as a visual or

cognitive map. There are several forms and adaptations of visual or cognitive mapping. Concept maps, thinking maps and mind maps (Davies, 2011; Hyerle, 1996; Kinchin, 2011; Lanzing, 1998; Novak, 1991) are forms of graphic organizers classified within Lengler and Eppler's (2007) category of concept and information visualization and in Sibbett's (2013) cognitive visualization parameter. Work by Novak (1991) associated with concept mapping and Buzan and Buzan (1996) establishing the concepts of mind mapping and radial thought provide a foundation for the multitude of visual and cognitive mapping techniques to follow. Differences between the types of cognitive maps can be described by evaluating the structure and overall purpose of each (Davies, 2011).

The following review focuses on the predominant types of mapping techniques utilized in learning environments identifying and describing their usage and benefits, and describing their importance and contribution to infographics research. The cognitive mapping tools described herein are fundamental to the construction of infographics. The composition, placement, and utilization of cognitive maps within infographics make them essential building blocks for developing visual representations of understanding and are thus included in the review.

Mind maps. Mind maps are visual representations of thinking (Buzan & Buzan, 1996; Davies, 2011; Santiago, 2011) that utilize frameworks for illustrating information in a non-linear format (Tucker, Armstrong, & Massad, 2010). Mind mapping and the concept of radial thinking (Buzan & Buzan, 1996) is a substantial contribution to the underpinnings of visual thought. Buzan's influential work with mind mapping is repeatedly referenced and expanded into various adaptations and forms of cognitive mapping schemas. Mind maps improve learning, presentation skills, reading

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performance, and research abilities (Munim & Mahmud, 2011) and have a variety of applications in the learning process (Enright & White, 2012; Santiago, 2011; Tsinakos & Balafoutis, 2009). It is this variety of applications in the learning process that is particularly important as it relates to creation of infographics and therefore of particular interest for this study.

Concept maps. Concept mapping is a process of relating or associating concepts in a two-dimensional, spatial format (Lanzing, 1998) to establish a hierarchical structure for understanding (Santiago, 2011; Davies, 2011). Concept maps promote critical thinking, inspire conceptual thought, and serve a communicative function (Lanzing, 1998). Concept maps promote understanding by engaging the student in a process of incorporating structure, organization, and arrangement of information (Davies, 2011; Kinchin, 2011).

Thinking maps. Thinking maps are visual tools that utilize a common visual language and organizational framework to promote and explore thinking processes and mental model construction (Hyerle, 1996; Santiago (2011) and can develop a wide range of metacognitive skills (Santiago, 2011). Thinking maps utilize visual metaphors as a construct. Visual metaphors establish connections, improve comprehension, and facilitate understanding of a particular context at a level that enables representation of that context in a different form (Serig, 2008).

In addition to the specific applications and benefits already described for cognitive mapping there are specific applications for this study in the context of learning environment design considerations. Mapping tools have been found to actively engaging learners (Davies, 2011, Mattos, Mateus, & Merino, 2012), facilitate creativity (Anderson,

1993), facilitate exchange of multiple perspectives (Wheeldon & Faubert, 2009), and support collaborative knowledge construction (Naykki & Jarvela, 2008). These are important considerations because these benefits meet identified teaching and learning needs also associated with infographics.

Some believe that mind mapping research is just beginning to emerge (Tucker, et al., 2010). Surfacing from the literature is a possible intersection of cognitive mapping techniques pointing to the potential adaptation and evolution of more powerful cognitive mapping techniques (Davies, 2011; Santiago, 2011). This also correlates to findings within graphic organizer research pointing to more engaging uses of proven graphics-based learning strategies (Alshatti, et al., 2010). A convergence of combined mapping processes is emerging with distinct yet unrealized pedagogical advantages leveraging each form of visual mapping (Davies, 2011). One such potential application of this convergence might be infographics.

Graphic Facilitation

Graphic facilitation is a compound visualization method designed to provide overviews and structural information about a topic (Lengler & Eppler, 2007). These interactive and participatory processes involve the use of visual imagery to elucidate and conceptualize multifaceted topics (Pearse, 2007). Graphic facilitation utilizes visual-based templates (Sibbett, 2013) similar to graphical formats utilized with graphic organizers. In many ways the principles of graphic facilitation build on other forms of visual techniques. Graphic facilitation is an active and synchronous visualization process of recording real-time ideas and discussion utilizing graphics in a format that provides meaning for those involved (Espiner & Guild, 2012). Graphic facilitation is included in

this review because the concepts involved with this form of visualization method approximate the activities of infographics albeit in a different interactive context. Graphic facilitation typically involves utilizing large scale drawings for representing concepts, ideas, and topics as they are discussed to facilitate inclusion of multiple perspectives in the process (Espiner & Guild, 2012) and is similar in scope and function to the concept of group infodoodling (Brown, 2014). Graphic facilitation and infographics share many commonalities. The distinction between infographics and graphic facilitation can be found in the scale and application of method. What graphic facilitation does in terms of large-scale group recording, infographics are created and based on the observations and understandings of the individual learner.

Visual Note Taking

Visual note taking is a visual thinking and learning strategy that combines the proven learning strategies of traditional note taking, drawing, and graphic organizers and are parallel in construction and purpose to infographics. Visual note taking encompassing sketchnotes, infodoodles™, and edu-sketching, is important to the discussion of infographics and deserves a review due to the marked similarities. Visual note taking and infographics both serve to capture and convey understanding in a visual form. Visual note taking is not a new concept. Over three decades ago, Hanks and Belliston (1977) described visual note taking as the recording of notes using the combination of text and pictorial representations. Although the concept has been around for some time, the literature reveals only anecdotal accounts of the visual note taking phenomenon and an overall lack of empirical data and research related to the concepts of visual note taking. Two contemporary forms of visual note taking do emerge from the literature and are

reviewed defining and describing each form. Sketchnotes (Rohde, 2013), infodoodles™ (Brown, 2014), and edu-sketching (Pillars, 2016) are included in this review because of their similarity in form, function, and purpose to infographics. The similarity of these visual note taking and visual thought development constructs share similarities between processes and procedures utilized to construct infographics.

Sketchnotes. Sketchnoting is a visual note-taking concept developed by Rohde (2013) for capturing and developing visual notes. Sketchnoting is a focused visual/graphical approach to note taking that engages and solicits the concerted and active efforts of seeing, listening, thinking, and analyzing to develop a comprehensive graphical organization of ideas and information. Sketchnotes utilize textual content, shapes, imagery, and other visual elements to capture main topics and ideas emphasizing the process of actively listening and thinking to distill and establish meaning from information. The result of this processing and analysis is output into a visual form utilizing both words and imagery (Rohde, 2013). This visual/verbal interaction is supported by the dual coding theory introduced by Paivio (2010), which proposes that cognitive processes are resultant of mental interactions between a perceptual-based nonverbal system and a linguistics-based verbal system. According to Rohde (2013), sketchnoting promotes the holistic engagement of visual and verbal processes in the mind subsequently heightening the learning experience. This stimulates the enhanced recall of information, improves concentration and focus, develops listening accuracy, promotes idea generation, and cultivates analytical skills.

Infodoodles™. Infodoodles™ are similar in function and appearance to sketchnotes. Infodoodles™ as described by (Brown, 2014) are created as the result of

converting text-based and/or auditory content into a visual form utilizing text and imagery. The process of converting verbal information into visual form helps to structure, organize, and communicate complex information. Infodoodling promotes the comprehension, retention, and recall of information, enhances creativity and problem solving, improves concentration and insight, and contributes positively to the learning process (Brown, 2014).

      Edu-sketching. Edu-sketching developed by Pillars (2016) is a classroom-centric visual notetaking approach that promotes the purposeful and reflective visualization of thoughts by engaging a diversity of learners. As described by Pillars (2016), "Edu-sketching is visual note-taking with intention, specifically geared for the classroom or the academic realm as another strategy to enhance learning, as another avenue to reach our students of all ages, mind-sets, and abilities" (p. 13).

      Although not specifically included in Lengler and Eppler's (2007) Periodic Table of Visualization Methods, the sketchnoting, infodoodling, and edu-sketching visual note taking techniques would be categorized along with infographics as compound visualizations techniques in the family of graphic facilitation, infomurals, rich pictures, knowledge maps, and learning maps.

Drawing

      Drawing is a generative learning activity involving the creation of hand drawn objects and words (Alesandrini, 1984; Hanks & Belliston, 1977; Schwamborn, Meyer, Thillmann, Leopold, & Leutner, 2010). Drawing is a learning strategy for visually interpreting, evaluating, and analyzing issues and concepts promoting greater understanding and the cultivation of multiple perspectives (Hanks & Belliston, 1977;

Schwamborn, et al., 2010). Drawing helps to develop meaning and understanding, promotes connections within content, and is a learning strategy that supports the development of other learning functions (VanMeter, 2001, VanMeter & Garner, 2005; Kouvou, 2006).

Drawing as a learning strategy is important to this review because of its influence and contribution to the infographics phenomenon. Hanks and Belliston (1977) contend that before something can be captured in drawing form it must first be visualized in the mind. Being able to visualize a concept in the mind is a central tenet of infographics. Drawing as a learning activity shows promise particularly for the concept of infographics but much remains to be learned about how this activity can be effectively implemented as a viable learning strategy. Research is needed into the use of drawing as a learning strategy and into the development of learning conditions that support its implementation in the classroom (VanMeter, 2001; VanMeter & Garner, 2005). Infographics research may also contribute to extant knowledge about the influence of drawing to the learning process.

Convergence of Influences

The sketch-based infographic development approach utilized in this study is informed and influenced by various visual thinking methods. Sketch-based infographics are developed utilizing drawing techniques and visual thinking practices similar to (Roam, 2008; Roam 2009; Roam, 2011) and associated with sketchnoting (Rohde, 2013), infodoodling (Brown, 2014), edusketching (Pillars, 2016), cognitive mapping, and visual concepts similar to those employed with graphic facilitation (Sibbett 2010, Sibbett, 2013) and utilized in graphics organizers. Sketch-based infographics resemble a convergence of

each of these aforementioned visual thinking and visual recording techniques and methods.

Implementing Alternative Assessments

Lamb and Johnson (2014a) explain that infographics can be effectively used in a variety of curricular settings and according to Abilock and Williams (2014) can be used as an alternative to traditional research-based assignments. Toth (2013) adds that infographic assignments can be an engaging alternative to traditional assignments and contain similar tasks, competencies, and outcomes desired from traditional assignments. Extant literature on use of infographic-based assignments yields patterns and suggestions regarding the design, implementation, and evaluation of this alternative form of assessment. Research reveals emerging phases of pedagogical implementation and provides recommendations and suggestions for embarking on an alternative assessment journey. This synthesis of alternative assessment and infographic-specific suggestions will be utilized to inform the infographic training program associated with this research study.

Designing Alternative Assessments

The literature surrounding use of alternative assessment reveals a connection between the assessment utilized and the instructional methods employed (Drake, 2001). When designing alternative assessments instructors should consider the function and purpose of the assessment, the impact of the assessment to the learning process, and how students will demonstrate understanding. Sanders (2001) indicates that alternative assessments can be used as either a formative or summative assessment measure. Kumar (2013) identifies formative assessment as an iterative process engaging student and

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teacher in an ongoing evaluation, analysis, redesign, and implementation of actions and efforts designed to improve learning. Offerdahl and Tomanek (2011) suggest that alternative assessments used as a form of formative assessment are useful in evaluating student learning and student thought processes and provide instructors with an ability to monitor student progress in ways not possible with traditional, summative assessment practices. Additionally, alternative assessments can be utilized to inform, influence and direct development and implementation of instructional strategies (Buhagiar, 2007; Offerdahl & Tomanek, 2011; Schafer & Moody, 2004; Winograd, 1994). Anderson (1998) had previously established the benefits of alternative assessment to the formative learning process but Maclellan, (2004) questions the summative benefits. Maclellan found that although alternative assessment can benefit formative assessment practices, the use of alternative assessment for summative functions in higher educational contexts is questionable.

Anderson (1998) suggests that alternative assessments help students develop their own learning pathways and assist in the knowledge construction process by providing a holistic connected approach to teaching and learning. Valencia (1990) also identifies this connection reflecting that alternative assessments have emerged to reflect the alignment of teaching and assessment in the learning process and to provide a better, more comprehensive, representation of learning. Brooks (1990) suggests that teachers should continually develop and refine instructional strategies and provide learning tasks that promote student perspectives, inquiry, exploration, sense-making, and development of understanding. Brooks suggests that instructors cultivate a desire in students to pursue authentic learning by providing learning opportunities that inspire critical and original

thought. Drake (2001) suggests that alternative assessments should be developed that enable students to identify their thoughts regarding a subject and reflect their knowledge and understanding. Winograd (1994) agreed suggesting that alternative assessments be designed to support the desired learning outcomes, inform and direct the development of instructional strategies, and provide performance criteria. The following sections review the use of alternative assessments such as infographics.

Introducing Alternative Assessments

A survey of the literature reveals that the most common approach to implementing alternative assessment strategies involves first exposing students and teachers to the concept and providing opportunities for exploration and practice with the alternative assessment concepts. When considering implementation of alternative assessment strategies Corcoran et al. (2004) recommend a sequential approach for progressively introducing alternative assessment concepts in the classroom. Tepper's (2004) approach for introducing alternative assessment concepts involved demonstration of the assessment concept followed by student involvement with the assessment concepts. Similarly, to Tepper's approach, Allen and Flippo (2002) and Offerdahl and Tomanek (2011) utilized immersion and practice with the alternative assessment to provide and develop experience with the concepts. Allen and Flippo (2002) incorporated alternative assessments as a way to introduce student teachers to the concepts and benefits of using alternative assessments in the learning process. They found that by immersing students into the process of completing an alternative assessment, students were able to provide perspectives and opinions regarding the use of alternative assessments. They also found that exposure to alternative assessments in pre-service teacher education was effective in

preparing teachers for the use of alternative assessments as a teaching and assessment strategy. Offerdahl and Tomanek (2011) introduced alternative assessment strategies to instructors within their existing classes examining teacher perspectives before, during, and at the conclusion of the assessment to ascertain the perceived impact of the alternative assessment to the learning process.

These approaches for introducing alternative assessment concepts seem to contribute to use in the classroom (Allen & Flippo, 2002). Offerdahl and Tomanek (2011) suggest that instructors exposed to alternative assessment strategies will realize the instructional diagnostic capabilities and associated benefits to the learning environment afforded by such strategies. Offerdahl and Tomanek also observed that as teachers learned more about the power of alternative assessment in gauging student progress the instructional strategies employed shifted from teacher-centric to student-centric. Further Offerdahl and Tomanek found that experience with alternative assessments might influence the way the instructor views the role of assessment in the learning process. This study seeks to builds upon Offerdahl and Tomanek's approach.

Implementation Considerations

Instructor training. It is apparent from the literature that instructors need instruction on how to effectively employ alternative assessment strategies in the classroom. Allen and Flippo (2002) suggest that teachers be instructed on the use of alternative assessments in order to address requirements of changing learning environments. Offerdahl and Tomanek (2011) suggest an opportunity for training teachers on how to use alternative assessments by involving instructors in alternative

assessment activities in order to realize the potential benefits and to experience how alternative assessments can be utilized to improve learning.

Review and analyze existing infographics. The generally agreed upon approach for incorporating infographics assignments begins with an overview and analysis of existing infographics (Davidson, 2014; Gallicano, et al., 2014; Howes & Stevenson, 2013; Toth 2013) involving examples of good and bad infographic design (Davidson, 2014). This opportunity to review and engage in class discussion about infographics can be beneficial (Lamb & Johnson, 2014). Although most suggest that the instructor provide the examples, Davidson (2014) suggests an alternative approach involving the student selection of the infographic for discussion, analysis, and review.

Initial research and topic development. Once existing examples of infographics have been analyzed, the literature suggests that student begin working on their own infographics. Abilock and Williams (2014) suggest that infographic assignments begin with research and inquiry into an issue, topic, or question and engage in an iterative process developing and refining the focus of investigation. The initial phases of infographic topic development also involve consideration and identification of the intended audience, the reason for, the goal(s) of, and the focus for the infographic to be designed (Abilock & Williams, 2014; Lamb & Johnson, 2014a; Smiciklas, 2012). Toth (2013) adds that this process involves the selection or provision of a topic followed by identification of data sources, and provision of overview describing the proposed infographic to be created. Gallicano, et al. (2014) suggests that although the literature suggests that topics for infographic assignments can be either teacher-provided or student-generated there seems to be increased engagement when students have the

opportunity to develop their own topics (Gallicano, et al., 2014). Howes and Stevenson (2013) found further that the creativity in the process of developing an infographic is influenced by the amount of autonomy provided.

Structure, organization, and design considerations. Lamb and Johnson (2014a) recommend that upon development and statement of purpose for the infographic, the student should then evaluate the visualization type used to construct the infographic and as Abilock and Williams (2014) suggests begin the process of structuring and organizing the information collected. Abilock and Williams recommend that students spend a considerable amount of time thinking and planning the infographic development. Further, once the topic for the infographic is selected, the instructor should assist students in planning and performing the research and investigation process.

After the topic has been developed and consideration regarding structuring and organizing information has occurred, Abilock and Williams (2014) recommend that students apply principles of design to develop the infographic. Lamb and Callison (2012) as cited in Lamb & Johnson (2014a) provide a framework and categorization of seven forms of visualization that can be used in infographics. These include "charts and graphs, diagrams, illustrations, maps, organizers, images, and symbols" (p. 57-58).

When applying principles of design to infographics, Lamb & Johnson (2014a) suggest that students strive for simplicity of design, minimize use of text, introduce multiple visual elements, and utilize effective graphic and visual design practices, and include references and source information.

Importance of feedback. The literature also suggests that alternative assessment strategies may involve various levels of self and peer evaluation throughout the

implementation process. Kumar (2013) suggests that assessment involving instructional, peer, and self-evaluation and associated feedback are necessary to inform instructional practices. Offerdahl and Tomanek (2011) emphasize the importance of involving peers in the learning process and Allen and Flippo (2002) found that students experiencing and engaging with alternative assessments increased learning due to aspects within the assessment that require self and peer evaluation. Allen and Flippo also found that although students benefitted from both the self and peer evaluation components of an alternative assessment there is a need for instructional assistance in the evaluation of the work of peers. One of the most common instructional strategies revealed in the literature highlights the role and importance of feedback in the infographic development process (Abilock & Williams, 2014; Gallicano et al., 2014; Howes & Stevenson, 2013; Toth, 2013,). The feedback described includes that provided by the instructor and by the learner's peers. Creating an infographic should be an instructionally supported (Gallicano, et al, 2014) iterative process with multiple forms of feedback (Abilock & Williams, 2014; Howes & Stevenson, 2013) including feedback from peers (Toth, 2013), and augmented with opportunities for sharing and collaboration (Gallicano et al., 2014; Howes & Stevenson, 2013).

Evaluating alternative assessments. Buhagiar (2007) recommends that instructors utilize assessment measures that contribute to and monitor learning, provide necessary directions, guidance, and support in the attainment of learning objectives. Much of the literature describing evaluation of alternative assessment activities suggests the use of a rubric (Britton, 2011; Drake, 2001; MacKenzie & Zinn, 2008; Winograd, 1994). It is also suggested that rubrics not only serve as an evaluation mechanism but

provide a means to communicate assessment requirements, objectives (Britton, 2011; Drake, 2001), identify the process (Valencia, 1990) and performance evaluation criteria of the assessment (Winograd, 1994; Valencia, 1990). The most common form of assessment strategy utilized and recommended for evaluating infographics also involves the use of a rubric (Abilock and Williams, 2014; Davidson, 2014). Abilock and Williams (2014) suggest that infographic assignments should illustrate the learning outcomes achieved by the student and be evaluated by a rubric. Davidson (2014) agrees. Abilock and Williams (2014) add that opportunities exist throughout the design process to provide comment and direction in advance of final assessment of the project. The use of a rubric for evaluating infographics correlates to a suggestion for evaluating alternative assessments with rubric. Davidson (2014) also suggests that students need opportunities to present and display their work. These opportunities can come in the form of a class presentation or in a display of the infographic.

     Use of narratives. In addition to the use of a rubric for evaluation infographic assignments, research suggests that students should provide additional assessment components that further demonstrate learning. The use of various narrative components is suggested. Gallicano, et al. (2014), Purnell (1999), and Toth (2013) suggest that students provided a descriptive narrative to accompany the infographic describing their learning experience. Toth (2013) recommends further that students add a descriptive narrative of self-evaluation to accompany the infographic describing the infographic purpose and uses of design elements. Similarly, Gallicano, et al. (2014) suggests that infographic design projects be accompanied by a written work describing the infographic's intent, the

intended audience, how the infographic might be used and the intended interpretation of the infographic.

Need for Infographics Research

A review of the literature involving alternative assessments exposes a need to explore and evaluate specific alternative assessment methods in higher education settings, examine pedagogical and learning environment considerations for implementing alternative assessments, analyze training needs, and to examine the impacts of alternative and creative assessments to the learning process. Extant literature on the subjects of alternative assessment and infographics prescribe a need to explore alternative visual approaches to instruction (Gallicano et al., 2014) and exploration with assessments that improve learning in post-secondary education by empowering students with ways to demonstrate learning in new and non-traditional ways (Sanders, 2001). Further exploration is warranted into the use and perceptions of infographics in educational settings (Gallicano, et al., 2014; Howes & Stevenson, 2013) and how these alternative assessments meet the needs of different learners (Purnell, 1999), engaging both next generation (Lamb & Johnson, 2014) and non-traditional learners (Hay, et al., 2010).

Need for new types of assessments. The literature reveals a need for assessments that effectively capture, reveal, and monitor learning (Buhagiar, 2007; Purnell, 1999; Schafer & Moody, 2004; Sparapani, 2000), expose student need (Schafer & Moody, 2004), promote higher-level thinking (Sparapani, 2000), inspire critical thought (Brooks, 1990), support learner creativity (Corcoran et al., 2004; Mullen, 2010) and empower students with opportunities to demonstrate learning in new and non-traditional ways (Sanders, 2001). Sanders (2001) calls for new approaches to assessing student learning

and suggests that alternative assessment strategies, when combined with traditional assessment practices may improve the learning process in university classrooms.

Need to explore specific forms of alternative assessments. The literature exploring alternative assessments also reveals a need to expand existing research and to explore uncharted territory involving specific alternative assessments in specific contexts. Hay, et al. (2010) found the use of concept maps as an alternative form of assessment effective at providing opportunities for learners to demonstrate knowledge in new ways. They describe an opportunity to explore other forms of alternative assessments in higher education. Corcoran et al. (2004) call for the infusion of creativity into the assessment process, a suggestion echoed by Tepper (2004) who recommends that creative and alternative assessments be evaluated for use in all types of classrooms arguing that creative assessments benefit learners in many ways.

Need for educational application of infographics. The review of extant research related to infographics as alternative assessment reveals a need for further exploration along several fronts. These include further study into the use and perceptions of infographics in educational settings (Gallicano, et al., 2014; Howes & Stevenson, 2013;), as a means to engage next generation learners (Lamb & Johnson, 2014b), as a form of alternative, more visual approach for teaching (Gallicano, et al., 2014), as an educational tool to develop abilities in creating and evaluating infographics (Toth, 2013) and development of abilities to communicate visually (Cano, 2011) and the role of visual literacy in the creation of infographics (Howes & Stevenson, 2013).Further research into the infographic design process, technology applications for designing and producing

infographics and applicability and analysis of infographic use in education is warranted (Howes & Stevenson, 2013).

Need to explore learning environment considerations. There remains a paucity of knowledge and little being done regarding the development of instructional environments conducive for and supportive of productive application of alternative assessments (Buhagiar, 2007) such as infographics in educational pedagogy (Howes & Stevenson, 2013) and the application of visualization techniques to the learning process (Callow, 2005; Callow, 2006; Reyes, 2011; Rosier & Dyer, 2010; Search, 2008). Buhagiar (2007) adds that even though numerous alternative assessment forms have been introduced, these assessments have not been widely accepted or implemented and recommends that current forms of assessment processes be challenged, examined, and reevaluated. The call has been made by researchers (Corcoran et al., 2004; Tepper, 2004) to explore and evaluate creative assessments for use in all types of classrooms, and according to Hay, et al. (2010) specific evaluation of alternative assessments in higher education classrooms is particularly warranted. Howes and Stevenson (2013), suggest a lack of research involving infographics and despite the popularity and benefits of infographics, little research is available to analyze their use in an educational setting suggesting that further research involving application of infographics in educational pedagogy is necessary.

Need to explore training implications. Some argue (Brown, 2014; Cano, 2011) for additional training and practice involving visual communication of information. This need for training extends to teachers, who could benefit from exploration of alternative assessment as part of teacher preparatory and training programs (Allen & Flippo, 2002).

Training and development of visual literacy and visual thinking skills may help students cope with challenges in the learning environment (Brown, 2014; Daniel & Parada, 2009; Rezabeck, 2005) and address the need for new learning, evaluation, and support approaches (Alshatti, et al., 2010; McMacken & Witherell, 2005) providing educational opportunities and perspectives not previously utilized (Callow, 2006; Search, 2009). Cano (2011) states that many struggle to effectively utilize visual formats to communicate information and to complicate matters there is a lack of training in development of visual communication of information. Although enhancements to learning performance have been shown to be positively affected by incorporating graphics into the instructional process (Lai & Newby, 2012), there is currently no targeted instruction regarding visual literacy and no prescribed method or strategy for teaching visual literacy skills (Yenawine, 1997). Additional training appears necessary in order to employ infographics strategies in the classroom. Using visual tools requires training and practice in order to develop the skills necessary to capture and distill ideas and concepts (Brown, 2014). A pedagogical model for implementing an infographics educational strategy could help meet post-secondary educational needs. However, examples of infographics training models and programs in a post-secondary educational context appear somewhat limited.

Lack of research into infographics provides opportunity for this study and advances the research into post-secondary educational utilization of an alternative, creative, visual-based infographics teaching and assessment strategy. Further study into how infographics strategies impact specific learning contexts appear warranted and could contribute to the advancement of infographics research. Extant research identifies current

utilization of various visualization tools in educational settings but falls short of quantifying the post secondary educational application of infographics. The post-secondary use of infographics as a form of alternative assessment lacks the formal research necessary to develop educational best practices and implementation in post-secondary learning environments.

This study seeks to expand on Howes and Stevenson (2013) by exploring the use of infographics in post-secondary educational pedagogy as a form of alternative assessment and Gallicano, et al. (2014) by exploring perceptions of post-secondary faculty relating to the use of infographics as form of alternative assessment. Abilock and Williams (2014) hypothesize that many infographic assignments merely display information in a graphical format but fail to actually convey the learning that has occurred. This study seeks to explore the post-secondary classroom application of infographic and to research the perceived educational benefits and challenges associated with this form of alternative assessment and to inform post-secondary pedagogical application. Further, this research seeks to learn if use of infographics as an alternative assessment can engage next-generation learners as proposed by Lamb and Johnson (2014b) and engage non-traditional learners as proposed by (Hay, et al., 2010). Finally, this study seeks to investigate ways of incorporating infographics as an alternative assessment in developing training to support communication utilizing visual formats and visual communication skills as suggested by Gallicano et al, (2014) and Cano (2011) along with the need for research into the role of visual literacy in the construction of infographics (Howes & Stevenson, 2013).

The study of infographics as alternative assessment in higher education expands the existing alternative and creative assessment research by studying a specific type of alternative assessment in a specific context. Researching the use of infographics in a higher education setting as proposed by this study explores and evaluates a specific form alternative assessment in higher education settings (Sanders, 2001), examines pedagogical and learning environment considerations for implementing alternative assessments (Buhagiar, 2007), examines student perspectives (Offerdahl & Tomanek, 2011), influences to teacher training (Allen & Flippo, 2002), analyzes the impacts of alternative and creative assessments to the learning process (Hay, et al., 2010), and explores teacher perceptions and perspectives regarding the use of infographics as a form of creative, alternative assessment. A pedagogical model for implementing an infographics educational and assessment strategy could help meet post-secondary educational needs. However, examples of training models and programs for infographics in post-secondary contexts are limited. Also limited are prescriptive conditions for utilizing infographics strategies in post-secondary learning environments. Lacking is information regarding optimum learning environment conditions, and teacher perceptions regarding usage of infographics, and factors influencing implementation of infographics strategies in post-secondary educational environments. This study embraces these calls for research and reflects this need within the construct of the study.

CHAPTER THREE

METHODOLOGY

Introduction

The purpose of this qualitative study is to explore the phenomenon of infographics in a post-secondary learning environment to determine the perceived impacts, influences, and contributions of infographics to the educational and assessment process and to develop a research-based model for educational application, teacher training, and learner support. It is anticipated that implementation of infographics strategies will positively influence instructional design considerations, enhance teacher perceptions regarding alternative assessments, provide prescriptive conditions for employing infographics as alternative assessment, and provide suggestions on how to support learners engaged with infographic activities. This research explores the experiences, perceptions, and characteristics of post-secondary teachers exposed to infographics concepts identifying factors that promote or inhibit pedagogical application of infographics as a learning and alternative assessment strategy. Outcomes of this research address identified research needs, expand existing research, and could significantly influence how infographics and other visual thinking strategies and practices are integrated into the post-secondary learning context potentially altering current instructional design and pedagogical assessment approaches.

Research Questions

1. How do post-secondary teachers perceive, make sense of, and understand the infographics training experience?

    a. How can infographics be utilized in post-secondary educational contexts?

2. What do post-secondary teachers perceive to be factors that facilitate and barriers that impede the use of infographics as a form of alternative assessment in post-secondary learning environments?

   a. What constitutes an educational environment that is conducive for and supportive of infographic application in post-secondary educational contexts?

3. What do post-secondary teachers perceive to be the skills development, training, and support needs associated with implementation of infographic-based assessments?

Rationale for Research Approach

The constructivist paradigm appears to be the most appropriate for this particular study however, it is noted that tendencies toward a postpositivist paradigm were carefully considered. As described by Hatch (2002), a constructivist approach embraces the role of unique, individual experiences and perspectives in the construction of a reality and recognizes the influence of the participant and the researcher in the collaborative process of developing meaning. The design and structure of this particular study is based upon exploring and understanding the individual experiences, perceptions, and perspectives of post-secondary faculty participating in an infographics training program.

Rationale for qualitative research approach. A qualitative approach to this research was selected because the research questions posed explore the experiences and perceptions of students and teachers exposed to infographics strategies. Qualitative research involves studying the lived experiences and perspectives of people within a natural situational context for the purposes of constructing and framing understanding

(Hatch, 2002). Qualitative research seeks to understand the contextual nature of a phenomenon exploring how those experiencing a phenomenon develop meaning about and from the experience (Denzin & Lincoln, 2011). In contrast, quantitative studies seek to quantify and measure, test hypotheses, establish cause and effect relationships, and focus on the generalizability of results (Lichtman, 2010; Denzen & Lincoln, 2011).

Rationale for phenomenological case study methodology. This study seeks to explore the lived experiences and perceptions of participants exposed to infographics training utilizing the phenomenological case study approach. A phenomenological study can be used to capture the experiences and nature of a phenomenon (Lichtman, 2010). A case study approach can expose experiences of a particular phenomenon (Hatch, 2002) and is a form of research that can be utilized to understand and describe a process (Woodside, 2010). It is important that this study reflect the beliefs and insights of the participants exposed to the infographics training and to explore their experiences and thoughts regarding their interaction with constructs associated with the infographics phenomena. The case study provides a comprehensive and contextual view of a particular phenomenon (Hesse-Biber & Leavy, 2011). This study seeks to explore the experiences, thoughts, perceptions, and insights of faculty regarding the process of creating infographics. The phenomenological case study approach seems to be the most appropriate form of study methodology based on the goals and objectives of this research study and parameters of the constructivist paradigm.

The phenomenological methodology provides a structured approach to evaluate the experiences of the study participants before, during, and after exposure to infographics training and will provide insight into the perspectives of those experiencing

the infographics phenomena. It was anticipated that participants exposed to infographics training will describe their experiences and perceptions surrounding the infographics techniques providing insights into how this phenomenon can be best utilized in the teaching, learning, and assessment processes.

Research Setting

The research setting for this study is a two-year, Associate Degree-granting community college in Kentucky. The community college selected for this study has both general education and technical/professional education programs. This research site was selected based on two factors. First, the site provided access to a sufficient number of post-secondary educational faculty from a variety of educational disciplines to adequately fulfill the sample composition and size requirements for this study. Second, the site had the training facilities and instructional technologies necessary to support the infographics training sessions and the research activities.

Research Sample

A research study sample was selected based on the representativeness and relationship to the processes being studied (Gerson & Horowitz, 2002). The sample for this study was a training cohort comprised of eight (8) post-secondary faculty participating in an infographics training program during the spring 2016 semester. This sample provides an appropriate, diverse, and representative mix of faculty necessary to inform the research questions and is of sufficient size to promote delivery of the infographics training program. Faculty from a variety of academic and technical disciplines including Health Sciences, Arts and Humanities, Mathematics, Natural Sciences, and Business and Professional Services, were sought to provide

multidisciplinary exposure and experiences for the research study. It was anticipated that this multidisciplinary approach might provide additional insights, perspectives, and perceptions than would be obtained utilizing a more limited, or single disciplinary cohort. The formation of a multidisciplinary training cohort was determined to be useful in facilitating the collection of information across the various teaching and learning domains and yielded information pertinent to the research questions posed.

  Participant selection. The researcher sought interested faculty with more than two (2) years of classroom teaching experience from each of five (5) major discipline areas of the college. These academic discipline areas included Health Sciences, Humanities, Mathematics, Natural Sciences, and Business and Professional Services. The researcher identified potential faculty from each of the academic disciplines and discussed the potential faculty with the respective Dean and/or Associate Dean from each academic area prior to contacting potential participants. I wanted to have faculty representative of each major discipline area at the college. I was looking for faculty with a wide range of experience with information visualization and infographics. I thought that having faculty with little to no experience with infographics would provide information to the study that might be different from that from faculty disciplines that are more visual in nature. Prospective faculty were then contacted directly by the principle investigator via email, phone, and/or personal visit using a recruitment script. I then met with each prospective faculty member to provide more detailed information about the infographics research program, procedures to be utilized and provided information associated with training program. Individual roles and responsibilities of the researcher and training participants were discussed as well as measures employed to protect participant

confidentiality. Potential applicants were included as part of the training and study cohort upon acceptance of the reviewed procedures, acknowledgement of roles and responsibilities, and signing of an informed consent form.

Participants. This research study included eight (8) post-secondary instructors from a rural community college in southern Kentucky. All participants have been teaching in the post-secondary environment for more than five years and agreed to participate in this study. Figure 4 provides a graphical overview of the participant demographic for this study and includes information relating to the participant's teaching experience, education level, teaching discipline and faculty rank. Many of the graphics in this document, including Figure 4 utilize the sketch-based approach taught as part of the infographics training program used in this study. Although not as polished and refined as a computer-generated graphic, the sketch-based infographic contains the same content and provides an example of sketch-based infographics utilized as part of this study.
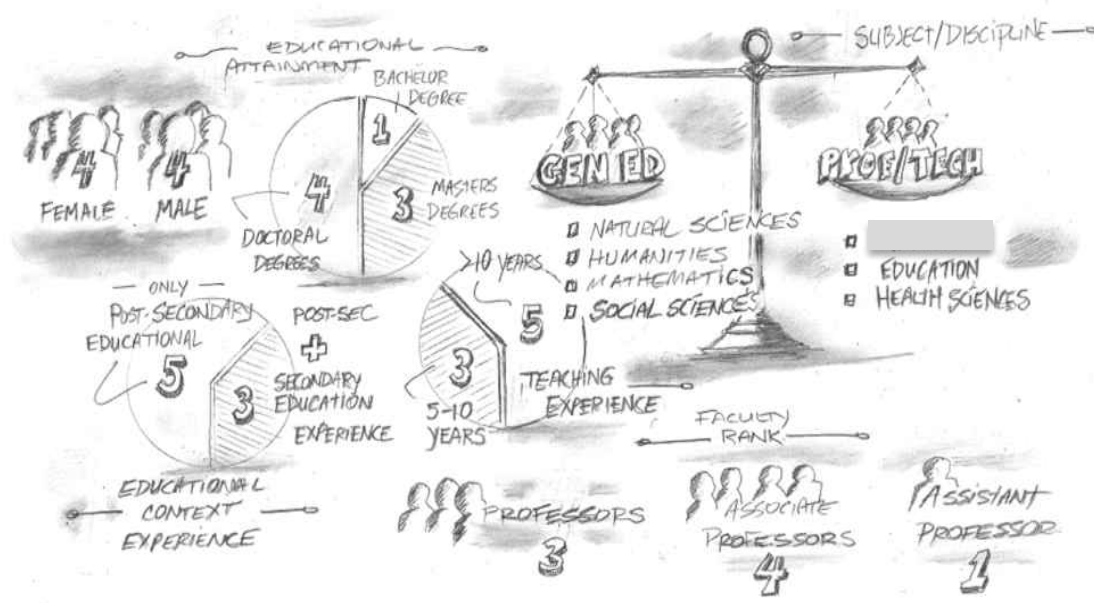
Figure 4. Graphical overview of participant demographics. Educational attainment levels, subject/discipline representation, educational experience, and faculty rank are graphically represented.

This sample of participants was diverse based on gender, age, experience, background, and educational discipline. The participants represent both general education and technical/professional discipline areas within a typical two-year, post-secondary educational institution. The participant group has a wide range of teaching experience from a variety of subject areas and disciplines. The educational and professional background of the participants is diverse. All participants are post-secondary educators with some having experience administering and coordinating academic programs. Half of the participants are female, half are male. Some were familiar with infographics going into the study some were not.

The multidisciplinary approach to the infographics training provides distinct and differing perspectives associated with infographics in the teaching, learning, and assessment processes. It is hoped that this multidisciplinary approach may provide additional insight into the experiences and perceptions about the infographics training experience. Input from the faculty should yield valuable insight into the actual training process and pedagogy providing training-related perspectives associated specifically to instructional outcomes and domains. Figure 5 provides a graphical demographic analysis of the study participants. Pseudonyms are used in place of actual participant names.
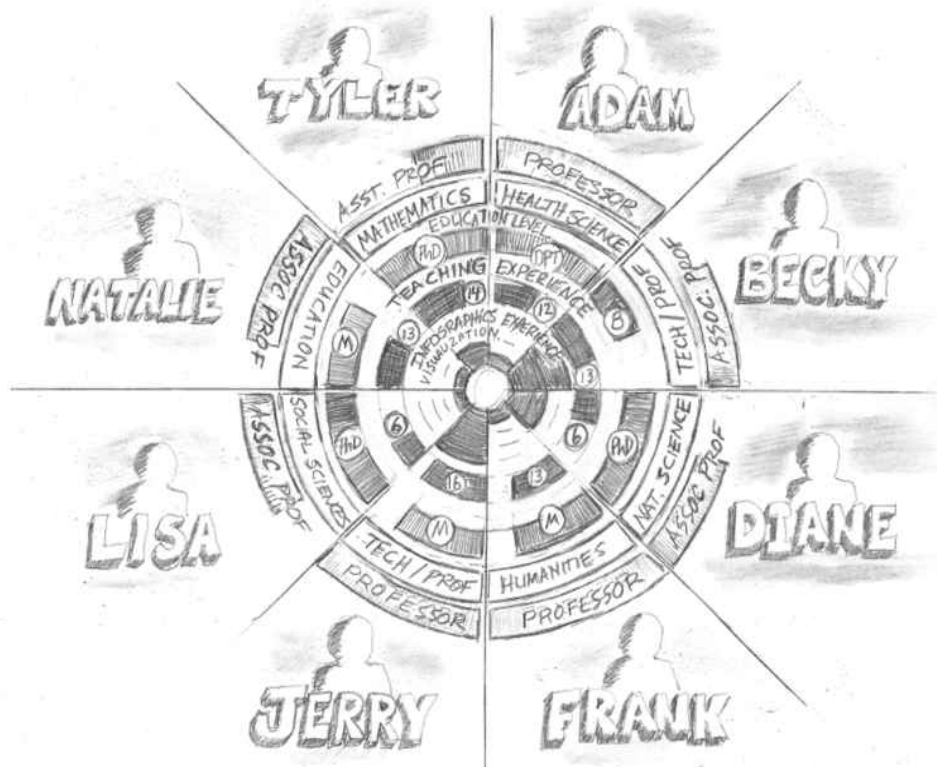
Figure 5. Graphical depiction of participant demographic information. The wheel graphic displays demographic information about each participant. Starting with the participant name and moving toward the center, information about the participant's faculty rank, subject area, educational attainment, teaching experience, and experience with information visualization/infographics is displayed. Using Diane as an example, she is an Associate Professor in the Natural Sciences discipline. She has a Ph.D, has six years teaching experience and has some information visualization experience. Information visualization experience is graphically represented by shading. The more shading equates to more experience, less shading equates to less experience.

The following provides general demographic information about each participant contained in Figures 4 and 5.

Adam. Adam has been a post-secondary teacher for 12 years. He is currently a Professor in the Health Sciences area with a Doctorate in the discipline in which he teaches. Adam has some experience with information visualization but not with infographics.

Becky. Becky has been a post-secondary teacher for 13 years. She is an Associate Professor teaching within the Business and Professional Services discipline. Becky has a

Bachelors degree in her discipline. She is familiar with infographics and has used infographics in her classes. Of the participants in this study, Becky is the most experienced with infographics.

Diane. Diane has been teaching in post-secondary education for six years. She is an Associate Professor teaching in the Natural Sciences academic discipline. Diane has a Ph.D. in her discipline. Diane has some experience with infographics and currently uses information visualization techniques in her courses.

Frank. Frank has been a post-secondary educator for 13 years. He is a Professor teaching in the Humanities academic discipline. Frank has a Master's degree. Frank is familiar with the concept of infographics but does not currently use infographics in his classes.

Jerry. Jerry has been a post-secondary educator for 16 years. He is a Professor in the Business and Professional Services discipline with a Master's Degree. Jerry is familiar with infographics but has limited experience using infographics in class.

Lisa. Lisa has been a post-secondary teacher for six years. She is an Associate Professor in the Social Sciences academic discipline. Lisa holds a Ph.D. in her discipline. Lisa is not familiar with infographics and does not currently use infographics in her classes.

Natalie. Natalie has been teaching in post-secondary education for 13 years. She teaches in Business and Professional Services discipline. Natalie has a Master's Degree in her discipline. Natalie does not currently use infographics in her classes but does use other forms of information visualization in her teaching.

Tyler. Tyler has 14 years of experience teaching both in secondary and post-secondary education. He teaches in the area of Mathematics and has an Ed.D. Tyler is familiar with infographics but does not use them currently in his classes. He does use other forms of information visualization in his classes.

A larger sample size is preferred but limitations involving the training class size and format preclude a larger group. The sample size and demographic makeup should provide sufficient randomness between faculty roles to answer the research questions posed. The researcher acknowledges that participant interest in infographics was utilized to encourage enrollment in the training program and research study. Results from this group may not be representative of those that perhaps show no interest in the topic of infographics. However, this does provide opportunity for additional study of those that show no interest in the subject. It should also be noted that enrollment in the training program is not indicative of particular interest in the infographic process.

Research Design

This section is provided to summarize the overall research design and is followed by a section describing the specific data collection methods. Each section contains details regarding a particular aspect of the research design. The research study utilized the following steps:

1. **Participant Selection** – Eight (8) faculty members from five academic divisions (Health Sciences, Business and Professional Services, Fine Arts and Humanities, Mathematics, and Natural Sciences) at the rural southern Kentucky community college were selected to participate in the infographics training and research program.

2. **Administer the Infographics Training Program** - The infographics training program was administered to the eight (8) selected faculty participants. The training program consisted of a three-hour session held during the Spring 2016 semester. The training program was developed and informed by a review of the literature regarding development, implementation, and evaluation of alternative assessment activities in higher education and was pilot tested prior to use in the research study. The pilot testing was used to refine and modify the training prior to delivery to the research study cohort. A descriptive overview of the infographics training program is provided in the following section and is also included in Appendix B.

3. **Conduct Observations** - Observations were conducted by the researcher during the training session utilizing detailed field notes, memos, and photographs.

4. **Review Infographics and Associated Narratives** - At the completion of the training, participants were asked to develop an infographic. Image analysis was conducted on faculty-created infographics project. Participants were also asked to include a descriptive narrative to accompany the infographic. This narrative was evaluated and analyzed along with the image analysis of the infographic project. The analysis was included as part of the researcher notes.

5. **Presentations** - Infographic training participants were asked to deliver a brief class presentation at the end of the training session. The presentation provided the participants an opportunity to explain the infographic creation process and provide the other participants with an opportunity for comments, questions, and discussion. The researcher facilitated this group discussion.

6. **Participant Interviews** - At the completion of the presentations and at the conclusion of the training program, in-depth, semi-structured interviews with each training program participant were conducted. The interview protocol utilized for the interviews is included in Appendix C.

7. **Data Analysis** - Data from participant observations, infographic projects, infographic presentations, and participant interviews were reviewed, analyzed, and interpreted resulting in findings.

8. **Findings Presented** - The researcher developed a narrative and associated infographics based on the research.

Infographics Training Program

Upon selection for the study, the eight participants were invited to a three-hour infographic training session. The infographics training session was based on a model I developed by the researcher called the SKETCH model. SKETCH is an acronym for the six-step process utilized to develop a sketch-based infographics. An overview of the SKETCH model and a description of each step of the model is included in the following sections. During the training session, participants were guided by the researcher through each step of the SKETCH model and at the conclusion of the training session each participant had completed a sketch-based infographic on a topic of their choosing. Participants then shared their infographic with the training cohort providing an overview of the infographic's purpose and an description of the process utilized to design and develop the infographics.

Training environment. Figure 6 shows the large multi-purpose computer classroom used for the training sessions. The room was arranged so that participants

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could sit as a group with each participant facing one another in a rectangular

arrangement. The researcher sat at the head of the table to deliver instruction. The

computer and projector visible in the Figure 6 was utilized to display online infographic

and sketchnote samples at the beginning of the training session. The majority of the

training session was conducted at the table in the foreground labeled as the "Participant

Work Area"
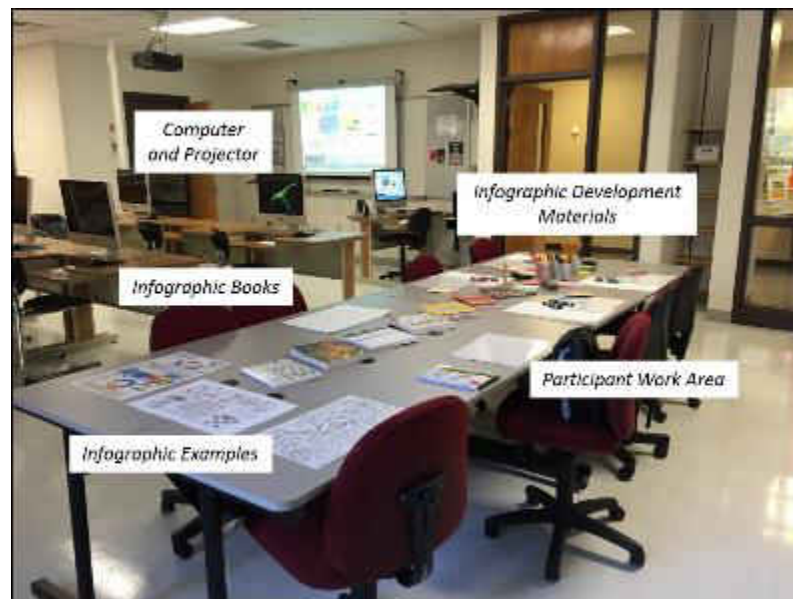
Figure 6. Infographics training room

     Various infographics and sketchnote reference books and examples were placed

on the table adjacent to the participant work area. The training room facilitated the fluid

nature of the instruction enabling participants to easily transition to other areas of the

space based on the training tasks. Figure 7 illustrates the training and support materials

that were available for the participants or used by during the training.
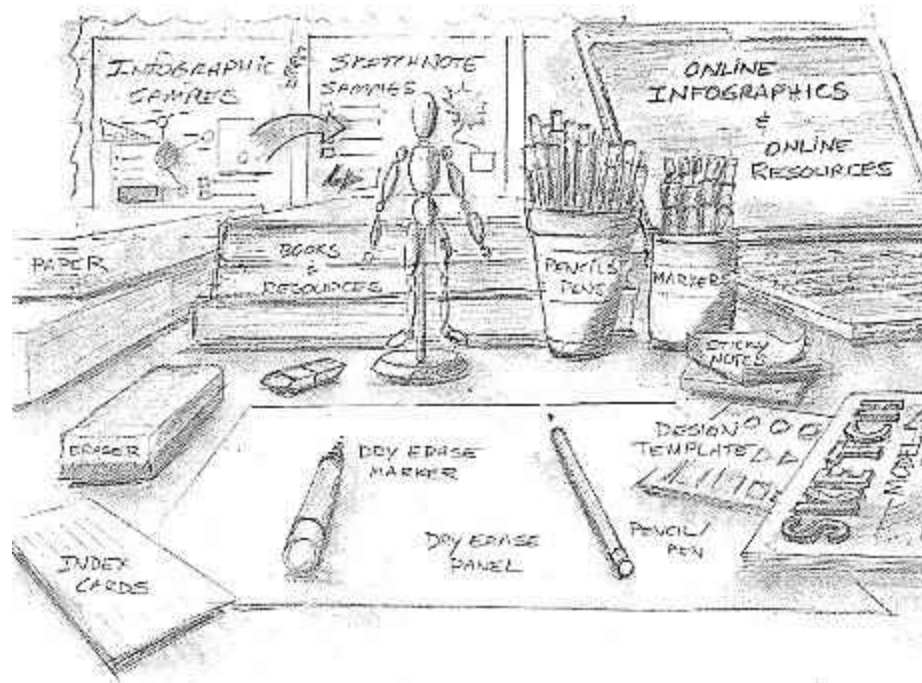
Figure 7. Infographic development training and support materials

Participants were provided a variety of resources to facilitate and support the development of their infographics. These materials and resources included, a SKETCH model workbook, paper in various sizes, pencils, pens, dry-erase markers, dry-erase boards, erasers, index cards, and sticky note pads of various sizes and colors. Drawing aids such as shape templates and a posable mannequin were also available.

Training session. The training session began with an overview of the research study and a brief summary of the training session objectives. At the start of the training session participants were shown samples of infographics from the Internet. Specific examples involving the participant's disciplines were included if available. I wanted to show the participants different types and varieties of infographics so that they would be better informed about the concept and have a better idea about what they were about to create during the training session. Once participants were shown several examples of

infographics we explored the training workspace and materials that were. The

participants selected a seat and gathered some materials of their choosing and then I gave

each participant a SKETCH model worksheet.

Our work with the SKETCH worksheet started with an infographic displaying a

brief history and overview of infographics. I wanted the participants to see how

infographics have evolved over time so that they might get a sense of where infographics

came from and provide them with the scope and types of infographics that have emerged

over time. During this overview we also looked at how the concepts of infographics and

sketchnoting had informed the development of the SKETCH model.

The SKETCH model. I developed the SKETCH model to guide the creation of

sketch-based or hand-drawn infographics. Each letter in the SKETCH model refers to a

distinct step in the process:

S – Select a topic/subject

K – Knowledge Construction

E – Evaluate/Encapsulate

T – Transform

C – Conceptualize/Create

H – Harmonize/Hone
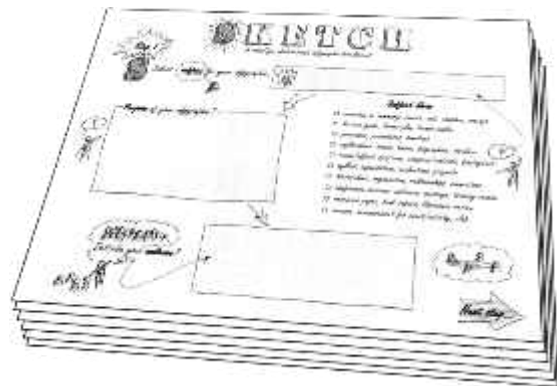
Step 1: Select a subject. The "S" in the SKETCH model involves participants

selecting a topic/subject for their infographic. This step requires identifying the subject of

the infographic and includes a description of the purpose and the intended audience of the

infographic. Participants were given time to complete the step and were provided

guidance and direction during the process. At the conclusion of this step, I asked each

participant to share their subject, the purpose and the intended audience. Figure 8

provides an illustration of the "S" step of the SKETCH model.
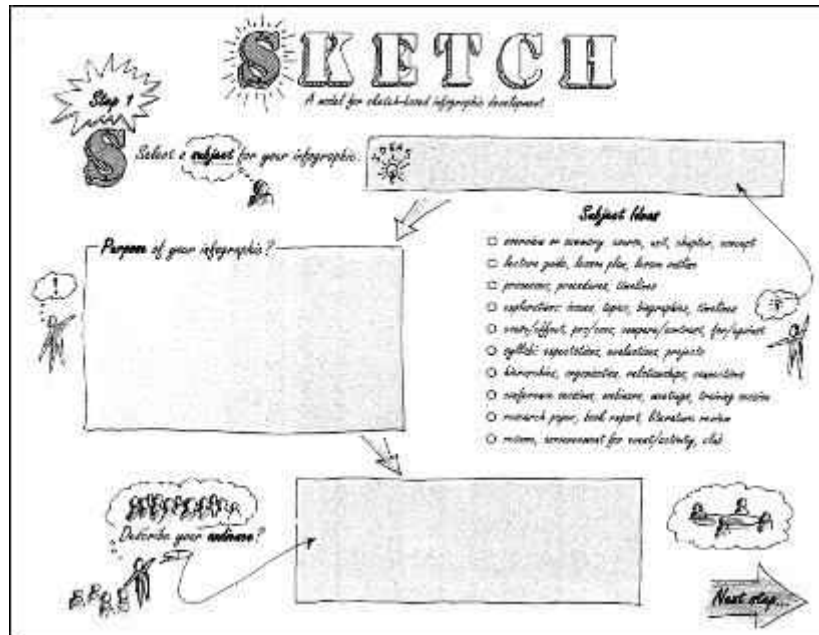
Figure 8. SKETCH Model: Selecting a subject step

   Step 2: Knowledge Construction. The next step in the process involves

identifying sources of data and information that will be used to develop knowledge "K"

about the selected subject. Examples of data and information were provided as each

participant thought about and identified data sources for their infographic. The topics

selected were within the subject areas of all participants and as a result, they relied on

their own knowledge and expertise for providing the data for the infographic. Figure 9

illustrates the "K" step of the SKETCH model.
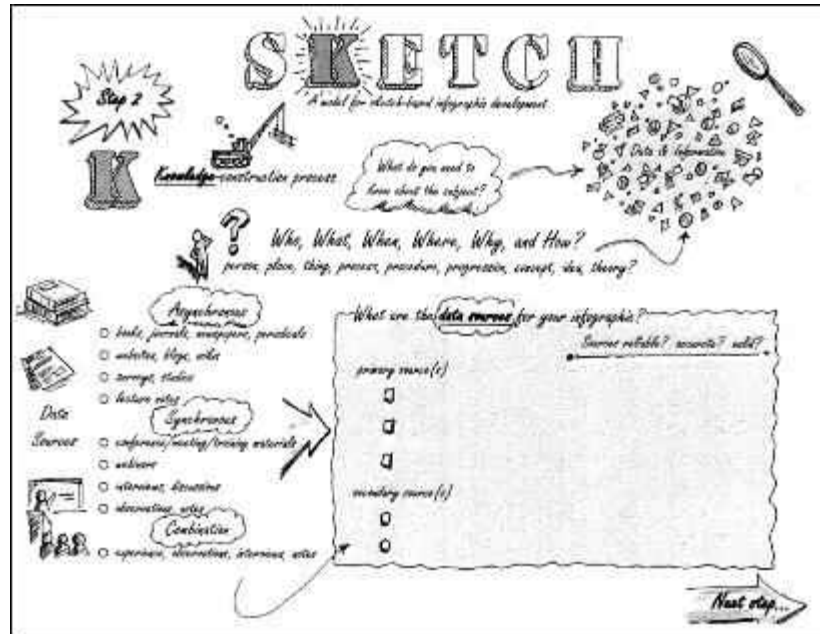
Figure 9. SKETCH model: Knowledge construction step

Step 3: Evaluate and encapsulate. The next step in the process involved the

evaluation and encapsulation "E" of the data for the infographic. Once the data and

information was identified, participants then chunked or grouped the data based on a

priority ranking. Related concepts were developed and ranked based on the relative

importance to the purpose of the infographics. We spent some time working on and

discussing this step because it involves looking at the data and information and providing

structure and prioritization to the data and information based on the infographic's

purpose. In this step, participants explored key concepts, patterns, connections, or

themes within the data. Supporting data along with interesting concepts were identified.

Categories and subcategories were identified by participants and then shared with others

in the group. Higher prioritized data would then be converted in the following step.

Figure 10 illustrates the "E" step of the SKETCH model.
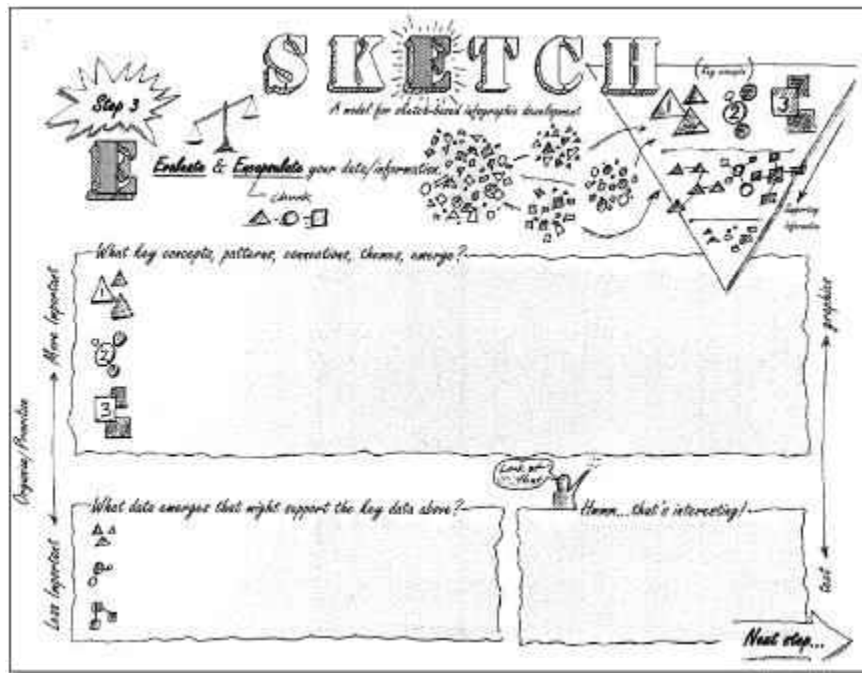
Figure 10. SKETCH Model: Evaluate and encapsulate step

Step 4: Transform. We then proceeded to take the ranked and prioritized

concepts from the previous step and looked at ways to transform "T" those concepts into

a visual form. We looked at various types of visualizations that could be used and

discussed how each might be used to represent specific concepts that the participants

identified. Participants were asked to identify a key concept from the previous step and to

transform that concept into a visual component using a combination of nine (9) visual

components. These visual components include basic shapes, typography, frames,

containers, figures, connectors, pictographs, dimensional characteristics, bullets, dividers,

and data visualizations including charts, diagrams, maps, and drawings. At this stage, the

participants utilized the dry-erase boards and scratch paper to begin working on

converting their concepts into a visual form. Participants then worked with each other to

talk about ways to visualize certain concepts. I also worked with each participant and

assisted with suggestions based on the concepts they had selected to visualize. At this stage, each participant explored various iterations and at the conclusion of the step had decided on a specific visualization format. Figure 11 illustrates the "T" step of the SKETCH model.
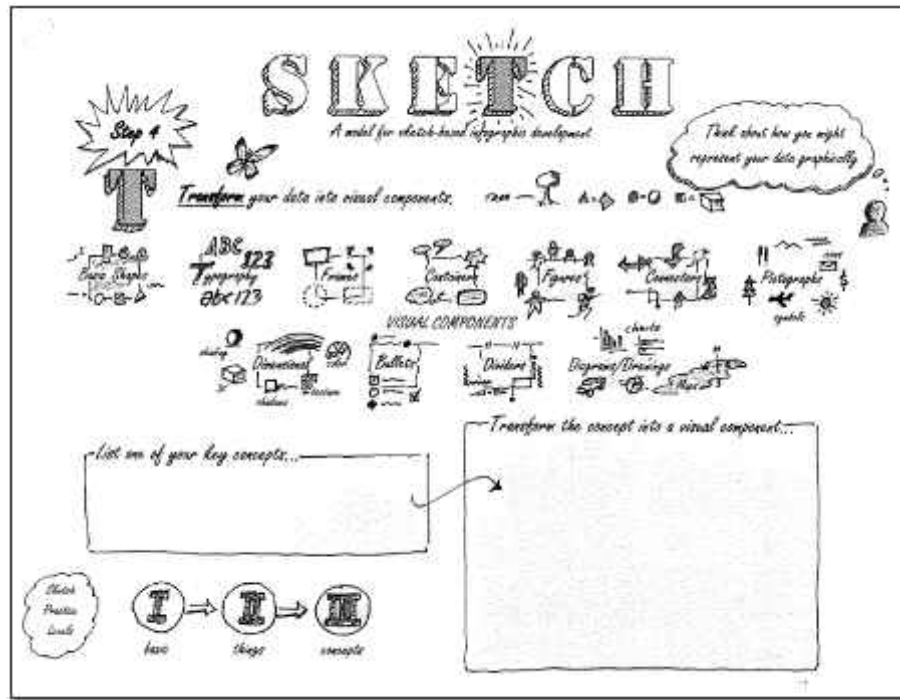
Figure 11. SKETCH Model: Transform step

Step 5: Conceptualize and create. Participants then took their visualizations and began working on a way to conceptualize and layout the infographic. At this step participants considered the overall layout and flow of the infographic making determinations about the patterns, arrangement, and basic alignments of the concepts. Examples were provided within the worksheet and participants again utilized the dry-erase boards and scratch paper to practice with some design concepts for displaying their infographic. Participants considered and selected an output format, a page orientation, a layout, and an overall flow of information for the infographic. An initial sketch was then

created to visualize the basic design of the infographic. Figure 12 illustrates the "C" step of the SKETCH model.
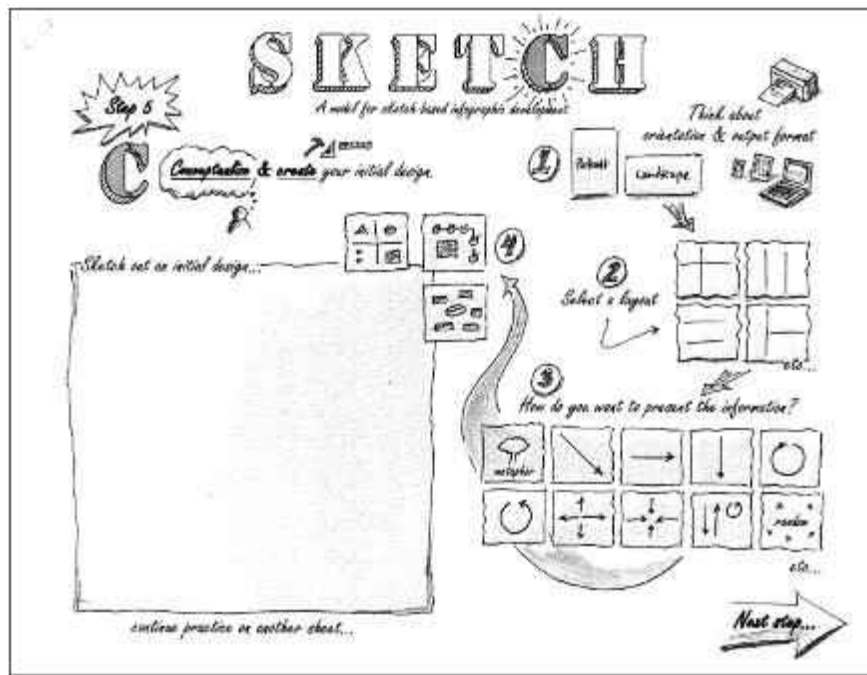
Figure 12. SKETCH model: Conceptualize and create step

Step 6: Harmonize and hone. The final step in the SKETCH model involved bringing all of the visualized concepts together in a rough draft of the final version. At this point, the visualized concepts are harmonized and honed "H" to deliver a visual message intended to address the purpose of the infographic and to meet the needs of the intended audience. Figure 13 illustrates the "H" step of the SKETCH model.
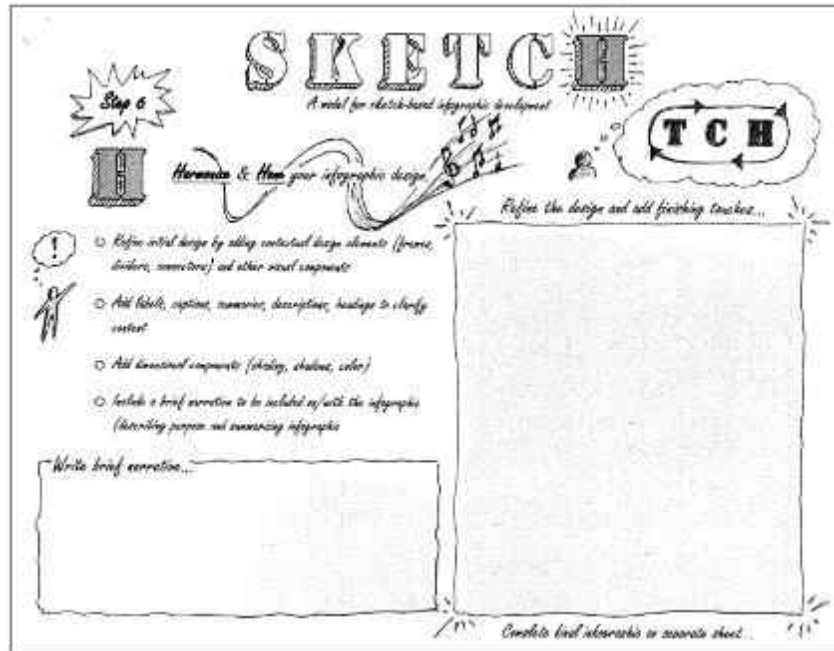
Figure 13. SKETCH model: Harmonize and hone step

At the conclusion of the training session, participants shared their draft infographics with the group and described the process of designing the final infographic. I then summarized each step of the SKETCH model and directed participants to evaluate their infographic using the SKETCH checklist that was included on the last page of the training packet. I then collected each of the participant infographics.

Data Collection

Qualitative researchers utilize an array of data collections methods to view a topic from a variety of perspectives (Denzen & Lincoln, 2011). The researcher utilized a variety of data collection techniques including observations, image analysis, group discussion, and individual interviews. The selected data collection methods conform to the constructivist paradigm and are appropriate methods to utilize. The researcher believes that the combination of approaches will help to extract experiential and perceptual data both during and after exposure to the infographics training program

providing insight into the perceived effectiveness of this specific visual thinking and assessment methodology. Prior to beginning the study, the researcher received Institutional Review Board (IRB) approval from the reseach site and from the researcher's university.

This phenomenological case study of eight (8) post-secondary faculty participants enrolled in a infographics training program seeks to understand the phenomenon and essence of infographics by exploring the lived experiences and perceptions of post-secondary faculty participating in infographics training and to develop a research-based model for post-secondary educational application of infographics as alternative assessment. To accomplish this outcome, the study explores infographics from an instructor perspective framing the study within visual thinking domains and applied within the learning constructs of the post-secondary learning environment. The research questions of this study are addressed using three primary information categories. These information categories are (a) instructional perspectives, (b) learning environment/pedagogical implications, and (c) training implications. These three categories of information will be supplied utilizing the following data collection methodologies and will answer the research questions posed.

The Role of the Researcher in Data Collection

The researcher in this qualitative phenomenological case study was actively engaged in every process of data collection as a participant and contributor as described by the constructivist paradigm (Hatch, 2002). The researcher was not an external observer but rather an interactive participant experiencing the infographics phenomenon along with the training participants. The researchers developed and facilitate the

infographics training session, conducted observations of study participants, conducted in-depth interviews, reviewed the participant's infographics activities, and facilitated the participant presentations and group discussions. The researcher was immersed in the infographics experience and thus shared in the development of meaning and understanding along with the training participants as prescribed by the constructivist paradigm.

Data Collection Methods

This study utilizes in-depth, semi-structured interviews as the primary data collection method. To supplement the interviews I utilized training room and participant observations, participant-created infographics and informal group discussion. I am reporting these methods based on their occurrence during the study. Observations are collected first as these observations occurred during the training session. At the conclusion of the infographics training participants shared the infographics they developed with me and their fellow participants. The training sessions were then followed by the individual participant interviews. The following section provides details about these data collection methods.

Observations. Observations were conducted during each of the infographics training sessions. Observations are commonly utilized as a method to document the activities of individuals or groups in natural settings for the purpose of better understanding a particular situation or occurrence (Lichtman, 2010, Rothman & Rallis, 2011). The study participants were observed experiencing the infographics training sessions and the researcher recorded detailed and descriptive observation field notes, and took photographs of the training facilities. These observations provided additional

information to the study regarding the observed experiences of participants in relation to different infographics stimuli and training activities. Photographs of the research setting were taken and stored digitally using utilizing digital recording media. All digital recordings were given descriptive file names identifying the date, time, location, and training session. All digital storage media were encrypted and backed up to additional digital storage media. The researcher utilized visual note taking to graphically record the training activities and utilized graphical recording techniques described by Brown (2014), Rohde (2013), and Sibbett (2013). These graphical recordings are incorporated into this document. These graphic recordings were converted into digital form using digital cameras and stored to digital recording media in the manner previously described.

At the conclusion of each training session, the researcher reviewed the activities of the training session, consolidated notes, and developed observation documents to record the events as part of a debriefing activity. The debriefing activity was intended to enhance the information captured as part of the observation process.

Image analysis: Participant-created infographics. In addition to participant observations, research participants were asked to create an infographic as part of the training program. The inclusion of images in qualitative research is suggested by Lichtman (2010) and is particularly appropriate for this study. Study participants were asked to create as infographic along with a descriptive narrative at the end of the training that depicts the topic or issue of their choice. In addition, study participants were asked to present their infographic to the training cohort.

Participant-created infographics, descriptive narratives, and participant presentations provide additional avenues for describing and interpreting the meaning and

sense-making processes experienced by the faculty participants. The participant-created infographics were converted to digital format utilizing a digital copier. The digital files was given a descriptive file name, stored on digital storage media and included in the findings of this research study. The digital infographics file is included in the . The researcher analyzed the infographics, the descriptive narratives, and the infographic presentations at the conclusion of the training. Individual infographics, descriptive narratives, and participant presentations were discussed with participants during the interview sessions. The participant infographics, descriptive narrative, and presentation provided a rich source for capturing the meaning of this phenomena as it relates to individual's training experience and helped to address and inform the research questions.

Presentations and group discussion. At the conclusion of the training program, research participants were asked to present and share their infographic projects with the training cohort. As part of the presentation process, all participants were provided an opportunity to present their infographic and describe their infographic development journey. At the conclusion of each presentation, the training group was given an opportunity to discuss the presentations and the infographic development process. The group discussion was included as part of the training process but was not used to capture specific responses. The use of the group process was only used to facilitate the discussion as part of the training. Group discussions are a form of interviewing that utilizes group interaction and a discussion format for capturing thoughts and ideas that might not surface with individual interviews (Lichtman, 2010). The intent of the research is to gain insight into common experiences and thoughts regarding the infographics phenomenon. The group discussions throughout the training and during the participant infographic

presentations exposed commonalities and provided additional insights which were included in the in-depth, semi-structured interview. This discussion process utilized during the infographics training session provided additional opportunities for collaborative group reflections on the infographics training experience and provided insight and perspective related to educational implications, challenges, and opportunities.

Interviews. Interviews are a commonly used form of conversational data collection involving interaction and dialogue regarding a specific issue or topic (Lichtman, 2010) enabling the researcher to investigate a phenomenon and construct meaning by actively engaging in conversation to learn about how people perceive and describe an experience (Mason, 2002; Rothman & Rallis, 2011; Hesse-Biber & Leavy, 2011). Interviews help researchers gain insight into a person's thoughts, perceptions, and experiences (Schostak, 2006). The perceptions and experiences of faculty regarding infographics training and the educational potential of infographics in post-secondary education are central to this study and contribute to the selection of interviews as a data collection strategy.

Field testing: Interview protocol. According to Roberts (2010) it is important that researchers field test instruments to be utilized in collecting data. An interview protocol appropriate for use in this study was not available and therefore the researcher developed an interview protocol (Appendix C). The interview protocol was developed and field tested utilizing volunteers from the Office of Institutional Effectiveness and Research at the community college involved in the study. The Office of Institutional Effectiveness and Research is familiar with the development of data collection instruments and was able to provide input as to the appropriateness of the interview protocol. The suggestions

received as a result of the field testing were incorporated into the interview protocol and were then utilized as part of this study.

The interview protocol collectively addressed the research questions posed and was developed based on the experiences provided by each participant during the training and those perceived as being learned during the training. The interview protocol consists of three (3) general demographic questions and 27 questions related to the research questions. The interview questions are categorized according to a) instructor perspectives, b) learning environment/pedagogical considerations, and c) training implications and will encompass five primary information domains including background/demographic information, information about the infographics experience, and information regarding the interpretation and meaning of the process, information regarding implications for the learning environment, and training considerations. Follow-up questions were added at the discretion of the interviewer based upon the interview process and experience. Individual, semi-structured interviews were conducted with participants using a 30 question interview protocol (Appendix C). The interview protocol was constructed in the context of the research questions of the study. A matrix showing the relationship between the research questions, interview protocol, and the themes resultant from the coding process is presented in Table 1. The interview protocol and theme matrix (Table 1) was developed to provide identification of each interview question, what information domain it addresses (background/demographic, the infographics experience, interpretation and meaning of the process) and what research questions are impacted.

Table 1

Interview Protocol/Research Question Matrix

	Interview Protocol
Research Questions	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
1 How do post-secondary teachers perceive, make sense of, and understand an infographics training experience?	(shaded across columns)
a) How can infographics be utilized in post-secondary educational contexts?	(shaded/dots)
2 What do post-secondary teachers perceive to be factors that facilitate and barriers that impede the use of infographics as a form of alternative assessment in post-secondary educational contexts?	(shaded/dots)
a) What constitutes an educational environment that is conducive for and supportive of infographic application in post-secondary educational contexts?	(shaded/dots)
3 What do post-secondary teachers perceive to be the skills development and training needs associated with the implementation of infographics-based assessments?	(shaded/dots)
Themes	D D D O O O/U L/O U O/D U L L A U A A U/A D/L D U T/D/A T/D T T/D U/T T/D T T O U O

D = Demographic   O = Open Response   U = Using Infographics   T = Teaching Infographics   D = Developing Infographics   A = Assessing Infographics   L = Infographics and Learning

Note(s): numerals below heading 'Interview Protocol represent questions of the interview protocol. Letters along the bottom represent the themes of this study and question types associated with the interview protocol. The shaded areas represent interview protocol questions that correspond to research questions. Letters along the bottom identify themes represented.

In-depth, semi-structured interviews were scheduled and conducted by the researcher at the conclusion of the training program utilizing the established interview protocol. In-depth interviewing helps to expose and uncover the contextual experiences of people and the associated meanings developed as a result (Seidman, 2006). The researcher and interview subjects signed confidentiality agreements and the procedures for safeguarding and securing the interview data were discussed with the interview subject prior to each interview. Pseudonyms were used in place of actual participant

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names to help ensure the confidentiality of responses. Permission to record the interviews in digital format was obtained prior to beginning each interview.

The interviews were conducted in the offices of each participant and recorded using a digital audio recorder. Participants were provided a copy of the interview protocol and a copy of the infographic they completed during the training at the start of the prior interview. Interviews were conducted within two weeks of the infographic training program. Each participant was interviewed once with interview sessions lasting approximately 60-120 minutes. All interviews were digitally recorded, catalogued, stored, and backed up on digital storage media. Detailed interview notes were also taken by the researcher throughout the interview to supplement the digital recordings. Participant infographics, descriptive narratives, infographic presentations, and observations were utilized as part of the interview process as previously described. Follow-up interviews were not conducted or necessary. The audio recordings of each interview were transcribed and stored on digital media. These transcripts were then printed and stored in a binder for reading and initial coding. All interviews were transcribed by the researcher and saved as a digital file, which were then analyzed by the researcher.

Data Analysis

Interviews. This section provides an overview of the data analysis processes utilized during this study. It is followed by a detailed description of the analysis procedures used according to the data collection methodology employed. Interview data was analyzed utilizing an intergroup and intragroup format to identify any group-specific and cross-group insights and perspectives related to the participant's academic discipline.

Data collected from the in-depth interviews were transcribed from the digital recordings and stored on digital storage media. Each transcript was then analyzed, coded, and categorized to reveal the common themes found across the interviews as described by Lichtman (2010). The researcher utilized a priori codes based on previous infographics training experiences. The emerging themes and patterns in the data were incorporated into a table of themes. Infographics data collected during the interviews from participant-generated infographics and associated presentations were analyzed, coded, and reviewed to identify thematic and pattern information. The resulting themes and patterns were included into the key concepts and themes of the study. As described by Lichtman (2010) I went through a process of coding, then categorizing the codes and finally refining the categories into key concepts. The coding process for this study involved several distinct steps summarized in Table 2.

Table 2

Coding Process Overview

Coding Process	Purpose/Outcome
Initial reading of transcripts	Reading for overview and context
Second reading of transcripts	A priori codes from interview protocol and emergent codes from participant responses noted.
Create coding document	Coding document created by extracting content from transcript and placing within a coding document
Condense codes into categories	Review coding document – refine and condense codes into categories; coding memos used to record thought process
Refine categories into major concepts/themes	Review coding document – refine and condense categories into key concepts/themes
Third reading of transcripts	Review responses by interview protocol item to gain additional contextual coding; codes included in coding document
Thematic tables created to display findings	Tables created to compile codes by theme; participant comments grouped by theme and by code
Graphics developed	Graphics developed for each major concept/theme to summarize content
Participant viewpoint documents created	Data from thematic tables was compiled into eight (8) participant viewpoint documents;
Fourth reading of transcripts	Viewpoint documents utilized to record areas of emphasis from each participant
Graphics developed	Graphics developed for each participant to summarize experience, perceptions, and insights shared during study

Each transcript was read fully to get an overview of the concepts covered. A second reading of each transcript was conducted and a priori codes derived from the interview protocol and codes emerging from the participant responses were applied. The coding process involved reading each participant's responses during the interview and then coding the comment based on a priori and emergent codes identified from the initial readings. A separated coding document was then developed to collect coded content from each transcript. As each transcript was read a third time, individual phrases, sentences, and/or paragraphs were copied and pasted from the original transcript to the coding document based on the appropriate codes. In many cases, the same content was placed in

multiple areas based on the applicability to the code being used. This process continued

until all interview transcripts had been coded and included in the coding document. The

coding document was reviewed to refine the codes into categories. The coding document

was reviewed and content condensed into the resulting categories. I followed this process

by refining these categories further into major concepts and themes. A contextual coding

process was also performed. Each of the interview responses was grouped by question

and then further analyzed. This process yielded additional contextual information based

on responses by participants to the same question. The coding that occurred during this

process provided additional contextual information to supplement the information

collected during the coding process described previously. The codes resultant from this

contextual review of the transcripts was combined with the coding document to provide

the findings for this study. Table 3 summarizes how the major concepts and themes of

this study were derived. A full list of codes developed as part of the initial transcript

reviews is included in Appendix D.

Table 3

Codes, Categories, and Concepts

Codes	Categories (a)	Categories (b)	Concepts/Themes
125 Codes	Characteristics of infographics Factors influencing infographic use Benefits of infographics Need for infographics Infographic challenges Developing an infographic Infographic training/resources Program/discipline issues Using infographics Teaching infographics Assessment and infographics	Teaching infographics Infographics and learning Infographic characteristics Using infographics Developing infographics Challenges teaching Challenges developing Overcoming challenges Need for infographics	Using infographics Teaching infographics Developing infographics Assessing infographics Infographics and learning

Note(s): Categories (a) displayes the initial group of categories condensed from the 125 codes resultant from the transcript review. Categories (b) represents a further condensation of categories; Concepts/Themes displays the overarching concepts/themes of this study.

The initial coding process yielded 125 codes. A full list of codes resultant from the coding process in included in Appendix D. I analyzed this initial list of codes and condensed them into twelve (12) coding categories. These categories were further condensed into nine (9) categories. I then distilled and refined these categories into the five (5) distinct concepts and themes reported in this study as follows:

I.   Participant thoughts about using infographics

II.   Participant thoughts about teaching infographics

III.   Participant thoughts about developing infographics

IV.   Participant thoughts about assessing with infographics

V.   Participant thoughts about infographics and learning

Coding memos and reflective journals were used throughout the coding process to record my thoughts regarding the codes being created and applied. I used these methods to record reflections and insight as they occurred. These coding memos and reflective journal helped to inform the context of the data and provide a placeholder for connecting the data with the process. This method was utilized so that the thought process involved with the coding process could be quantified and tracked. These coding memos and journal notes also contributed to the analysis process as information was concurrently analyzed and interpreted during the coding process as described by Stuckey (2015). The coding schema utilized for this study reflects the purpose of the study and the research questions (Stuckey, 2015). Thematic documents were then created for each of the aforementioned themes. Tables that combined participant responses with appropriate codes were created for each theme. Per Stuckey (2015) an initial review of the data was conducted and an initial write up regarding the theme was produced. These emerging concepts were then mapped to the research questions for analysis.

Observations. Observations of participants recorded on detailed field notes were analyzed to determine any overarching themes and concepts. Differences among disciplines within the training cohort were noted and incorporated into the study findings. This data was analyzed to develop any emerging themes and patterns found in the data. The emerging themes from the observation field notes and memos are included in the research themes.

Participant infographics. The participant-created infographic and descriptive narratives contained in the SKETCH model worksheets were analyzed by the researcher. The infographic images were analyzed based on the content, message, and design

principles utilized. The infographics images were analyzed to identify any emerging themes or patterns. The analysis of the infographic images is of particular importance to this research as it is an artifact that displays the perceptions and experiences of the individual participants and may correlate to other components of the study. Information resulting from this data provide additional insight into the research questions of this study. The analysis of the participant infographics was important to this research as they infographic product is an artifact that displays an alternative view of the perceptions and experiences of the individual participants to supplement the observational data. Information resulting from this data analysis provided additional significant insight into the research questions of this study.

Analysis of Findings

At the conclusion of the data analysis process I reviewed the emergent table of concepts/themes to identify patterns, themes, and/or concepts. Collectively these themes, patterns, and concepts were analyzed and studied to develop a more thorough interpretation of the data. The research questions of the study were evaluated based on the final analysis of data to develop findings and conclusions from the data. I also developed an infographic representing the analysis and findings of the study utilizing the same infographic presentation processes experienced by the participants.

Researcher Subjectivities

As prescribed by Peshkin (1988) the researcher acknowledges the following subjectivities. The researcher acknowledges a preference and inclination for utilizing visual thinking techniques similar to those presented in the infographics training sessions. Having employed visual-thinking strategies and infographics techniques in various

situations the researcher has experienced the benefits that infographics can produce. In fact, this experience with infographics and other visual thinking tools and methodologies has prompted study into the infographics phenomenon with the intent of sharing the results in the hopes of advancing infographics and learning strategies into a model for instructional application. The perspectives and experiences of the researcher were also used and contributed to the development of the infographics training materials and program. Being aware of these visual thinking tendencies, I closely monitored the development and delivery of the training materials and the associated data collection methods. My background and experiences with visual thinking techniques were utilized throughout and as part of the training program. I acknowledged and shared this bias and inclination to utilize visual thinking methodologies with all of the study participants. I have made every effort to separate bias and personal inclination from the course delivery, data collection, and data analysis processes. My background as a visual thinking practitioner and instructor had the potential to influence the interactions within the training session but I did my best to closely monitor these inclinations and tendencies to limit and mitigate any interference in the process.

Trustworthiness

I employed several strategies to ensure the trustworthiness of the study procedures and findings. First, the methods and techniques used to gather the data utilized well-established methods of observation, image analysis, group discussion, and interview. These methods are commonly used and each method employed followed strict guidelines pertaining to data gathering practices and data analysis and recording techniques. Second, the methods employed provided sufficient triangulation to ensure that the data collected

represents a comprehensive view of the phenomena studied incorporating insight from multiple perspectives and using multiple information sources. Third, the use of multiple academic disciplines provides enough variation and diversity to assess the results from multiple perspectives and viewpoints. Fourth, recording actual data along with analysis ensured the accuracy of all data and reflection documents for each stage of the data collection process. I have tried to identify and describe any perspectives and experiences that may have biased the implementation of the training and the interpretation of the results. Finally, the participants of the study volunteered to participate and agreed to provide an honest assessment regarding their experience.

Benefits and Risks of the Study

The benefits of this study should be many. Participants in the study should be able to apply new infographics tools and techniques in their personal, academic, and professional lives. These tools and techniques can be utilized to enhance their thought processes and should contribute to enhancements to their educational and professional development and practices. Exposure to infographics training should provide the added benefit of holistic, creative, and comprehensive thought applicable to a variety of settings. The training received as part of the study should enhance participant visual thinking and learning capabilities and skills thus augmenting existing educational and professional skills. Participants of the infographics training and research study will become familiar with the techniques and practices associated with incorporating infographics as alternative assessment and are able to implement infographics into their respective courses.

The risks of the study are minimal. The study was conducted in a relatively safe and stable academic environment and involved conventional training techniques and processes. All data collected will be kept confidential with pseudonyms being utilized. All data from the study will be stored and backed up utilizing an encrypted file system only accessible by the username and password of the researcher. All study participants were informed of the confidentiality measures utilized and were provided with a confidentiality form signed by both the participant and the researcher. In addition, IRB approval was sought and received by the IRB of Eastern Kentucky University and the Kentucky Community and Technical College System before commencing the study.

Limitations

A larger sample size is preferred but limitations involving the training class size and format precluded a larger group. The sample size and demographic makeup provide sufficient randomness between faculty roles to answer the research questions posed. The researcher acknowledges that participant interest in infographics was utilized to encourage enrollment in the training program and research study. Results from this group may not be representative of those that perhaps show no interest in the topic of infographics. However, this does provide opportunity for additional study of those that show no particular interest in the subject. It should also be noted that enrollment in the infographics training program is not indicative of particular interest in the infographics or other visual thinking and learning process.

The study is also limited in time available for exposure to infographics training concepts. Due to academic scheduling issues associated with the participant sample, the maximum timeframe for this study was limited to one, three-hour session. This time

frame limitation may impact the perceived benefits of the program, as participants may

not have sufficient time to fully learn and incorporate the infographics concepts. The

issue of training duration and time was addressed within the study by exploring training

related issues described by the training program participants.

The study utilizes a qualitative approach which does not produce generalizable

results. The findings and conclusions resultant from this study are intended to inform

others about the use of infographics based on the experiences, insights and perceptions of

eight (8) faculty in a particular and specific post-secondary educational context.

CHAPTER FOUR

FINDINGS

Introduction

This chapter provides the results of the research study. I want to start this section by providing an overview of the descriptive method I used to present the information and provide a rationale for the narrative format. My primary focus for the narrative structure is to immerse the reader into the essence of the infographic development experience by sharing the thoughts, insights, and perspectives of the individuals participating in the study. I also wanted to share how the cohort as a whole explained the experience. I thought it important to see how the individuals responded and how these individual responses compared and contrasted to the group as a whole. To guide this narrative journey I developed three main sections: Preliminary Explorations, Participant Viewpoints and Cohort Viewpoints. The narrative format for presenting the findings of this study is graphically presented in Figure 14.
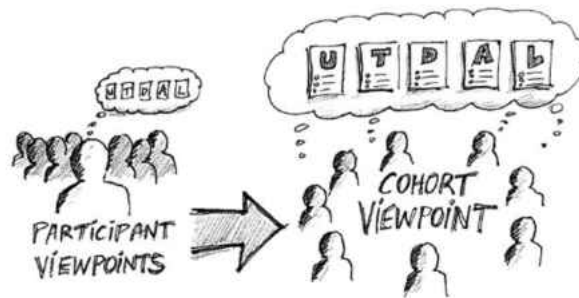
Figure 14. Overview graphic depicting the narrative structure of Chapter 4. The first part of Chapter 4 focuses on participant viewpoints; the second part of Chapter 4 focuses on the participant cohort.

Preliminary explorations. This section provides information related to the experiences and perceptions of the study participants prior to or at the beginning of the

training. Previous experience with infographics and/or information visualization is provided along with initial perceptions regarding participation in this research study.

Previous experience with infographics. I thought it important to talk with the participants about any background and experience with infographics and information visualization and to find out if the participants were bringing with them any previous infographic experience. Participant experience ranged from little to no experience to considerable experience with infographics and information visualizations. All participants indicated that they used some form of information visualization in their classes. Participants Becky, Diane, Frank, Jerry and Tyler all indicated that they had some familiarity with infographics prior to the training. Becky and Jerry had more familiarity with infographics than the other participants. Both Becky and Jerry have professional experience using infographics and experience using infographics within their teaching discipline. Adam, Lisa, and Natalie all indicated that they had no prior experience with infographics or information visualization prior to the training. Of all the participants only Becky and Jerry had any prior information visualization or infographics training.

Initial thoughts and perceptions. Before exploring the participant and cohort viewpoints I want to set the stage and establish a baseline from which the participants embarked on this study. Participant demographic information has been covered previously so I wanted to start this section to find out about participants thoughts and perceptions about and motives for participating in the study. As expected, participant responses were varied. Participants Adam and Natalie were interested in gaining new knowledge and learning about a potentially new way to teach. Participants Becky, Diane,

Frank, Jerry and Tyler had indicated an interest in the topic or that they were intrigued about the topic. Diane, Frank and Jerry added that they were excited about the opportunity. Participant Lisa responded that she did not really know what to expect saying, "I really didn't know, you know, what it was going to be like and didn't know honestly, I didn't know what an infographic was until that day [laughs]." Most of the participants (6 of 8) indicated that they wanted to participate in the study to gain more knowledge about infographics and learn how the infographic worked and how they were developed (Natalie, Tyler, Lisa, Adam, Frank, Diane). Others suggested that they were unsure about what to expect from the study or how it would pertain to them (Becky, Adam, Lisa).

Table 4 provides the thoughts and perceptions that the participants of the study shared about the infographic development experience. The table format and convention utilized provides a descriptive title and reveals concepts reflecting participant responses. Table rows are arranged in descending order based on the number of participants commenting on a particular topic. This table structure and format is utilized throughout the study.

Table 4

Participant Thoughts and Perceptions about the Training Experience

		Participant Comments							
Participant thoughts and perceptions about training experience	**#**	**A**	**B**	**D**	**F**	**J**	**L**	**N**	**T**
Wonderful, really good, good, interesting, fun, enjoyable	6		•	•	•		•	•	•
Revealed possibilities, eye opening	3		•	•	•				
Something different, new, fresh; innovative	2				•		•		
Learning about the process; wanting to implement	2		•	•					
Need for this type of assignment	1		•						
Organization	1							•	
More difficult than thought it would be	1						•		
Not for every single topic but certain things; has a place	1	•							
Revealed potential frustrations/drawbacks	1			•					

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Insights about the experience. Table 5 provides a summary of what participants identified as being learned from the experience. Participants shared insights, thoughts, realizations, and perceptions about the infographic development experience. The information contained herein also appears throughout the participant and cohort viewpoint section. This information is also included within the key themes and was extracted from the interview transcripts during the coding process. It is presented here to provide context to the discussions documented throughout this document and to provide an overview of the learning that was experienced by the participants.

Table 5

Participant Thoughts about the Infographic Development Experience

Participant thoughts about the infographic development experience	Participant Comments								
	#	A	B	D	F	J	L	N	T
Value of infographics as a teaching tool; stimulating, different, new way to learn	4		•	•			•	•	
Understand infographics more now; different types of infographics	3			•			•		•
How useful infographics can be	2	•			•				
Challenging activity; engages the mind	2	•			•				
Importance of organization, pre-planning, process	2	•	•						
How much information captured in an infographic	1		•						
Need for allowing time for creativity	1			•					
Liked infographic design environment	1			•					
Time-consuming nature of infographics	1					•			
Need for practice	1							•	
Realization that you don't have to be an artist	1	•							

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

I asked participants about their initial perceptions about the training and participating in the research study. I also was interested in learning more about their thoughts and perceptions after the training. Several questions of the interview protocol provide this information and these insights are shared throughout this chapter. These last two sections help to frame the initial thoughts about the infographic development experience and illuminate some overall perceptions and insights from participants. The interviews and coding process revealed the aforementioned concepts and contribute to the emerging themes of the study. Those thoughts and perceptions that are found within the key themes provide a much broader picture of the overall influences to the thoughts and perceptions of the participants both prior to and after the exposure to the infographics training.

Educational context influences. I asked the participants if the infographics training experience had influenced their thoughts about using infographics in an educational context. All participants indicated that indeed the training experience had influenced the way they thought about using infographics in an educational context. The participants also elaborated on how the training experience had influenced their thoughts about using infographics in their classes. Adam saw infographics as a way to get information about his program more efficiently to his students. Becky, who has taught infographics in her classes before, wants to convert her syllabus to an infographic. Diane focused on how students could benefit from the process of developing an infographic stating,

> I think previously I thought like it was my responsibility to create graphics that were a good representation of what I was trying to teach but I feel now that it's still valuable but it's valuable for me to have my students go through that process. I didn't appreciate that before. - Diane

Frank indicated that he could use infographics as an alternative to a current assignment. Jerry thought that the process of developing an infographic might be more difficult than other forms of instruction stating "It's harder than just going up there and doing normal instruction so it takes a little more effort but you do get more out of it." Lisa described that the training experience as one that "opened my eyes and my mind to something new…it get's us thinking in other ways. Natalie reflected upon the use of infographics in the classroom and said "I think this would be such a great way for kids to learn…I think it would be great"

Although this particular question specifically asked participants about potential influences other information was gleaned about potential influences involving infographics during the coding process. This information about the perceived influences of infographics in an educational context is included within the key themes presented in the participant and cohort viewpoints section.

Infographics in the teaching discipline. Once the participants had a chance to develop their own infographic and experience the process I was curious to see how they thought the experience they went through might apply to their discipline and post-secondary education in general. All participants indicated that there was a place within their respective disciplines for infographics. Adam pointed out that infographics "would be good because a lot of our stuff is visual anyway, and sometimes it is easier to memorize things from a visual concept than it is from a written concept." Participants mentioned that some courses such as Mathematics, Statistics, Biology, and Anatomy/Physiology had an inherent visual component. Most participants provided examples of how infographics could be used in their response to the questions. Throughout the interviews participants shared examples of how infographics might be used within their disciplines. Their ideas are included in the key theme "Using Infographics in Post-Secondary Education" covered in the participant and cohort viewpoint narratives.

Many of the participants including Adam, Becky, Diane, Lisa, Natalie, and Tyler also suggested that infographics would be good in disciplines in addition to their own. Adam pointed out that "everything requires some sort of planning process or thought process, some sort of sequencing." Becky adds "I just don't think there's anything that

they, it couldn't be used for...I can't think of a discipline it would wouldn't work." Becky did acknowledge that "now I don't think everybody is going to be as excited about it [laughs] as maybe I am." This is a sentiment echoed by Tyler. Tyler thought that infographics could be used in other disciplines but he cautioned that

> I think that if you don't watch out people will assume that you're breaking out the crayons and your being too childish in a way, I think some people are kind of opposed to that…the sage on the stage wouldn't want to do something like that.

Diane, Lisa, and Tyler all thought that infographics could be utilized in other disciplines but were unsure about the exact application. Diane suggested,

> In post-secondary education, I think it's good, I'm not sure all of the ways it could be applied but I certainly think in class as an activity to evaluate you know, to evaluate progress during class.

Lisa wasn't sure about the specific application of infographics in other disciplines either saying "I think they could maybe find some way to incorporate it in their classes." Tyler had a similar response, "I think it has a place in any educational setting whether it's my discipline or anyone else's, whatever stage you're in in your educational process." Tyler adds,

> I think it could be used, I think it has a place, where? I don't particularly know yet and when I don't, I mean it's just one of those things I don't know about, I kind of have a feeling it, it has a place.

Similar to Becky's response, Natalie adds, "Oh gosh, I think everybody could use it." She also said, "I don't think it's for everybody, and, but I think about every discipline could use this, I don't think that there would be a discipline that couldn't use it, they may

use it in a different way…but I think every discipline could use this." Natalie also points out that general education classes could potentially benefit from using infographics noting, "it would be a great way to make their fields a little more enticing or just a different way to learn."

Infographics and understanding. After developing an infographic on a topic of their choosing, I was interested to see if developing the infographic improved the understanding of the participant about the topic. All of the participants selected a topic from within their teaching discipline and the topics they developed included concepts that they were knowledgeable about and familiar. Of the participants that responded to this question, only Adam indicated that it did not necessarily improve his understanding of the topic but he indicated that he could see where it would help others that were not as familiar with the subject. Adam said, "It didn't necessarily improve my understanding of it, but it did definitely provide me with a way to increase understanding from other people." Natalie did not really address the question but provided examples of how the process reminded her of mapping. Six of the eight participants responded that the process had helped them to understand their topic better. Becky stated, "You know I think it did [improve understanding about the topic]." Diane described the experience, "I think it was definitely helpful. It helped me appreciate the complexity of the idea." Frank seemed to impacted by the experience the most of the participants:

> It helped me to think about it in terms of, the different sections of it and how each
> of them have their own, unique, or relatively unique, I guess functions, but they're
> all interconnected and then they're all informed by the same strategies, and so I
> talk about each of those elements separately anyway, but the infographic I think

helps to tie it together, and it was tying together for me, the idea that you know, like logos, ethos, and pathos, in particular, that those concepts do, can inform and feed all the aspects of an argument and all aspects of the essay from introduction all the way through to conclusion. And I know that, and I'm sure I say that in some way in class, but it's, you know, knowing it and, and briefly saying it is not the same as really seeing it and understanding it, so I was kind of, actually seeing it in a fresh way, in maybe even a deeper way and that's kind of almost embarrassing to admit that I didn't get the full impact of, you know, I know the importance of it, but I didn't, I can understand it and see it in a deeper way now.

Frank continued,

That concept just really gave me a better understanding of it [subject for the infographic], a deeper understanding, so of course it would with students too, I think. That was actual discovery about my own topic as a result of the infographic. I mean, that's awesome, and so obviously shows the potential for, for me and this concept in particular.

Frank added,

Actually what I'm saying though, I think I just actually talked myself into seeing it as valuable, and not that I didn't see it as valuable, more, but valuable even in composition, worth the time to show the students how to do it, because if they can have the same experience with some, any concept somewhere along the way that I was having with a concept that I've taught literally three hundred times, maybe a lot more than that, but I'm seeing it in a new, fresh way, well, you know I'd like

for students to have that same experience so it would be worth it to bring it in, to make that happen, try and make that happen for them.

Similarly Jerry contributed,

This is a topic that I knew going in [describing the topic Jerry selected for his infographic] but this help, as I say you break it down, you see, you look for connecting things, so I, you know I think it helped me understand it a little bit more. You know I knew it but when you see it all together it really, even for me, helps promote understanding of it…it gives me a better perspective and understanding of the subject.

Lisa acknowledged that she was already familiar with the topic that she was using for her infographic. I asked about what she thought if someone unfamiliar with the topic was asked to develop an infographic. Would it improve their understanding of the topic? She replied, "I think it would. Because it's just like anything else, you're going to have to research it, and look it up, or figure it out, or learn about it, so yeah, I think it would." Tyler responded to a similar question, "It would be extremely beneficial."

Participant Viewpoints

Participant viewpoints provide an overview of the infographic development experience of each participant. I wanted to engage the reader by experiencing the infographics development process as viewed by and explained by each participant. I structured the reporting of the findings in what I refer to as 'Participant Viewpoints'. Participant viewpoints provide experiential snapshots into how each participant explained their infographic development experience and provide insights and perspectives about the

endeavor. Table 6 provides an overview of the structure utilized to present the findings of the participant interviews. Each participant viewpoint is structured using this format.

Table 6

Overview of Narrative Structure: Participant Viewpoints

Participant Viewpoint Narrative structure	**Information provided in each narrative section**
Participant demographics	Participant overview, background, work experience, educational experience, information visualization experience
Infographic overview	Description of infographic developed; example infographic provided as part of narrative
Experience categorization	Categorization of each participant based on the five key concepts and themes of the study. Participants assigned a categorization so the reader can see areas of comment and emphasis
Thematic overview	Participant comments and information related to each of the five (5) key concepts and themes of the research. Thematic overview arranged by the participant experience categorization

In each participant viewpoint narrative, we see demographic information about the participant including a summary of the participant's experience with information visualization and/or infographics is provided. We also see the participant's subject/discipline area, their educational background and experience, and other pertinent demographic information are also provided. Demographic information provides some context and familiarity about the participant prior to revealing the findings of the study. The demographic information is intended to frame and inform the thoughts, perspectives, and insights being shared during the study. Participant demographic information is followed by an overview and example of the infographic they developed during the training. The infographic summary provides the actual infographic that the participant developed along with the general intent or purpose of the infographic. The infographic information is included to provide additional context about the participant and to display

the actual infographic that they are referring to throughout the interview. Charts and graphics depicting the participant's views grouped by the major concepts and themes or the study follow the demographic and infographic information. The charts and graphics provide insight into how each participant responded to the interview questions. An overview of participant responses grouped by major concept and theme graphically display the areas that each participant commented about and emphasized during the study. Participant responses within the themes of the study contribute to the assignment of what I refer to as an experience classifications. Experience classifications are composed of each of the main concepts/themes of the study. U-D-T-A-L is an example of an 'experience classification'. In this example, the U represents the theme *Using Infographics*; D represents the theme *Developing Infographics*; T represents *Teaching Infographics*; A represents *Assessing with Infographics*; and L represents the theme *Infographics and Learning*. The experience classification of U-D-T-A-L means that this participant commented and emphasized the theme *Using Infographics* more than the next theme, *Developing Infographics* and so on. The purpose of using this classification system is to see, at a glance, the areas of comment and emphasis for each participant. The experience classification can also be utilized to compare and contrast among cohort participants. The experience classification is then followed by the thematic narrative of each participant. The thematic narratives include comments and quotes by each participant along with tables and figures providing additional information regarding each theme and topics within each theme.

Participant Viewpoint - Adam

Adam has been a post-secondary teacher for twelve years. He is currently a Professor in the Health Sciences area with a doctorate in the discipline in which he teaches. Adam indicated that although he was familiar with some forms of information visualization he admits that he is not very familiar with the infographic form of information visualization. I asked Adam about what he thought about participating in a research study about infographics. Adam replied, "I wasn't really sure how it (infographics) would pertain to the classes I taught…" he added that he participated in the study, "…Not really knowing that there would be anything I would be able to take away from it."

Adam developed an infographic to communicate the process for applying for admission into his academic program. He wanted to develop an infographic that would simplify the steps and process of admission. The purpose of his infographic was to help applicants understand the process of applying to a health sciences program. Adam's infographic is presented in Figure15.
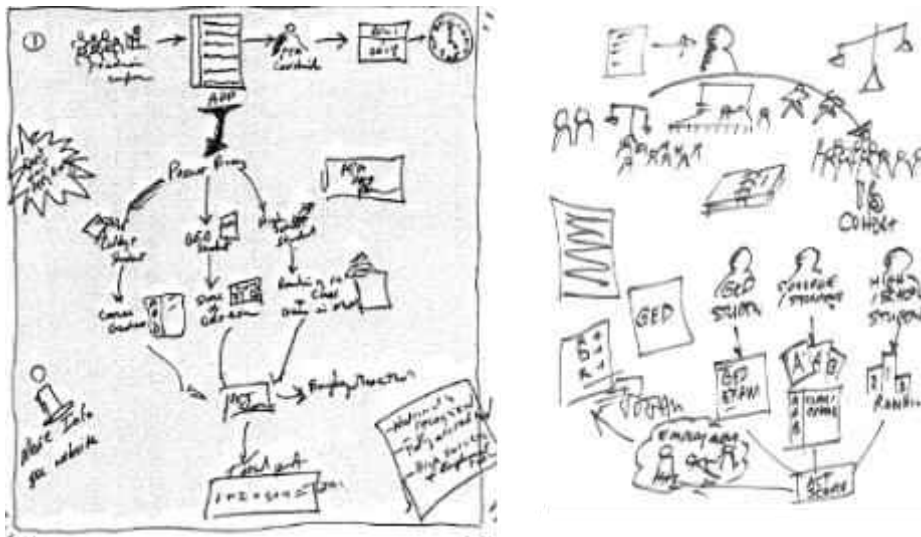
Figure 15. Adam's infographic

115

Figures 16, 17 and Table 7 provide an overview of Adam's comments during the interview. These comments are grouped by the key themes of the study.
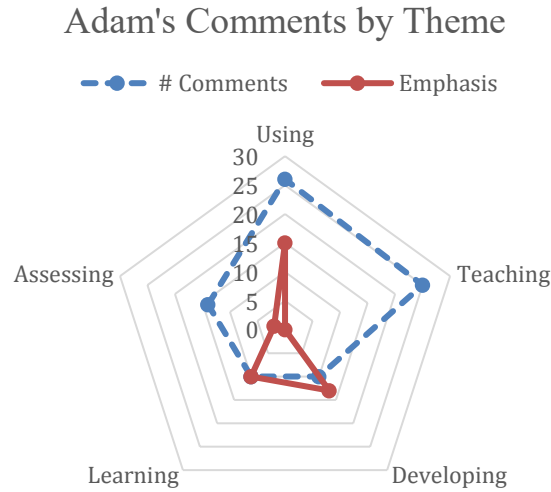
Figure 16. Adam's comments and emphasis by theme – radar chart. The dotted line in the figure represent comments made by Adam related to the themes of this study. The solid line represents areas that Adam emphasized.
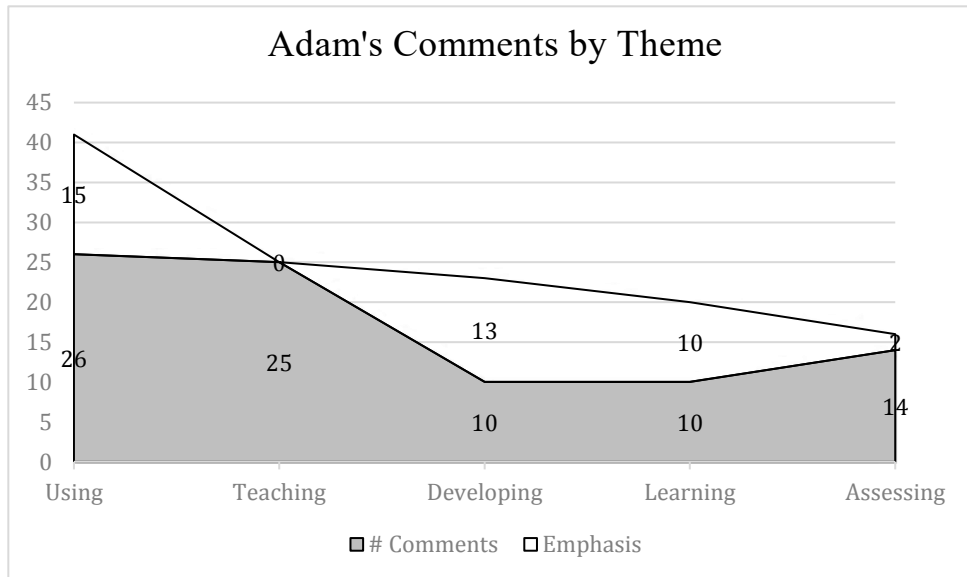
Figure 17. Adam's comments and emphasis by theme – area chart. The area at the bottom of the graph displays comments made by Adam related to each of the study themes. The area at the top of the figure provides additional comments made by Adam emphasizing comments and themes.

I classified Adam's overall experience classification as U-T-D-L-A based on the comments he made and the emphasis he placed on the concepts that make up the key themes. Table 7 provides the number of comments Adam made and the times he emphasized concepts within each of the key themes of the study.

Table 7

Adam's Comments and Responses by Theme

	Themes	**# Comments**	**# Emphasis**	**Total**
U	Using Infographics	26	15	41
T	Teaching Infographics	25	0	25
D	Developing Infographics	10	13	23
L	Infographics and Learning	10	10	20
A	Assessing with Infographics	14	2	16

The following sections provide detailed information about the concepts Adam mentioned during the interview along with an overview and specific responses that he shared. The themes are listed in the order associated with Adam's experience classification: U-T-D-L-A. Subsequent participant viewpoints follow this same approach.

Using infographics – Adam. Using Infographics was a theme that received a lot of emphasis from Adam. Concepts he mentions in this theme include a rationale for using infographics in post-secondary education, determining the appropriate place to use in a course, uses in his discipline and in post-secondary education in general and perceived challenges or factors influencing the use of infographics in post-secondary education.

Rationale for using infographics in post-secondary education. Adam reflected that using infographics might provide way to communicate information to a more visual generation of students and appeal to visual learners.

I can see especially with this generation the time that we're in seeing things that

are streamlined, very quick recognition items, that it definitely has its place, it's

not for every single topic but there are certain things that it lends itself to

especially when you are trying to get a broad amount of information in a concise

format, to help streamline it maybe get progressions on how things should

progress, that kind of stuff, and people are more visual these days, especially

processing information so, I can see how that would work out.

Adam shared that visual learners might benefit from using infographics. He explained,

Yeah, because it makes you think about how you could utilize things and convey

things to different learning styles because everybody's got different learning

styles so this is just another avenue on how you can teach individuals, especially

visual learners, pathway learners people that learn by pathways, that's always a

good thing.

Efficient way to convey information/teach. Adam explained that infographics

might provide a more efficient way to convey information and teach students. He

described that having information in an infographic format provided a means to share

information quickly. He offered, "It would be extremely beneficial; it would streamline

the process. I think you could actually teach somebody what is going on in just a fraction

of the time of what it would take than if you had it written out on paper." To this concept

he added, "You know, a concise systematic approach to presenting information rather

than long printed out PowerPoints or outline notes, or whatever they're utilizing." Adam

thought infographics could convey information about his program to students more

efficiently.

I am in a field where you have to process information pretty quickly and any sort

of visual diagrams you can put out there for students to pick up on, or potential

students is where I am really focusing on this is people trying to get into our

program. I think it is really going to speed up the process when they are trying to

say what do I do to get into this program. At least give them a more sequential,

better understanding outline of what they need to do.

Adam also thought that infographics might help an instructor assess how effective

they are communicating information to students. In addition, Adam thought that the

infographic development process could benefit both the teacher and student. He says,

It also makes you think about the information that I've already trying to convey.

Am I really conveying that in an effective way or am I just doing this because it

was a traditional way of doing it? So that's how it has influenced me. As far as

things I've taken away from this is how to organize things logically from what I

want to get across; try to be more concise with information and the points; do

things that are sort of eye-catching, you know, draw your reader to things that you

are really wanting them to know first and to sort of draw them in and then break

off the smaller points from that avenue and just planning process, you know. I

think that is something students need to work on too, how to plan things and how

to go through a sequence.

Formative assessment. Adam shared that using an infographic might also provide

an instructor with a way to quickly analyze and assess student learning. He describes

supplementing or modifying an existing instructional process.

Right now they are currently utilizing PowerPoint but they do have to go through a statistical analysis. They, we print out one for each student, however, I can see where an infographic, doing an infographic page to go along with that would be a nice quick scan thing to kind of encompass everything that they are presenting on.

Challenge students creatively. Adam mentions another potential reason for using infographics in post-secondary education. He did not believe that students were asked to develop things on their own but rather supplied with information from teachers. He thought that this would be challenging for students but would benefit learning. He said, "Yeah, it would be challenging activity. As far as most students go, visual things are good anyway, however, I do not think students are challenged enough to really to be creative and come up with things on their own, they are often just handed things."

Determining an appropriate place to use infographics in a course. Adam admitted that he struggled with trying to find a place for infographics in his classes. He attributed this struggle to his inexperience with infographics stating, "Well, the biggest challenge was to see to try and figure out a area where I could utilize infographics just because of my lack of experience. The more experience you get I think you can apply it to more things obviously." He suggested that an infographics assignment might provide a way to supplement his existing instruction rather than replace an instructional activity, "I was getting ready to say, possibly an alternative but more of a supplemental than alternative, at this point."

Uses for infographics in the discipline and other post-secondary disciplines.

Although Adam struggled with finding a place for infographics in his discipline, he did provide insight into some possible uses. He thought that there would be a place for

infographics in his discipline and provides some examples. Adam also thought that infographics could be used in post-secondary education citing different discipline areas.

I can see it maybe not as an alternative for every single item, but I can see it for several different avenues especially when we are looking at the body and going through different forms of muscle contractions and there's different terminologies that go into that, can they understand those things and those are concepts that students have a difficult time learning so I can see how that can definitely be beneficial. And then as far as post-secondary education in general I can see for certain classes very likely, I mean I can already visualize a nice, for a history class, a nice timeline with little different icons for different points in history, for significant items; for science you know I could see processes you know you talk about mitosis, myosis those things for development of cells I can see how an infographic would work there. Math formulas, you know, processes of going through and working out math formulas, I can see how it would work there, I mean there are several different things.

Table 8 provides an overview of infographic uses identified by Adam during the interview.

Table 8

Uses for Infographics - Adam

Infographic Uses - **Adam**
• Presenting information, communicating information
• As supplemental activity; for some items
• Student presentations
• Administrative communication
• As alternative assignment
• Way to quickly assess student understanding
• Way to challenge students creatively

Adam describes seven (7) specific uses for infographics in post-secondary education. Of these uses, Adam emphasized the use of infographics for presenting/communicating information, the use of infographics as an alternative assignment and/or supplement for some activities, and as a way to challenge students creatively.

Factors influencing infographic use - Adam. Table 9 provides a summary of factors and influences affecting the use of infographics in post-secondary education.

Table 9

Factors Influencing Infographic Use - Adam

Factors influencing use of infographics in post-secondary education - **Adam**

Teacher influences

- Instructor understanding content enough to develop infographic
- Instructor knowing how to follow steps to develop infographic
- Teacher resistant/hesitant to change
- Instructor attitude; overall attitude of higher education
- Challenge to teacher abilities
- Instructor understanding infographics
- Concept unfamiliar to teachers, limited experience with
- Challenge perceptions about how teachers currently teach

Curriculum influences

- Differences by discipline/class type/assignment type
- Difficulty determining where to use, determining best fit

Time influences

- Takes time to learn (learning curve)
- Extra time needed; time challenges
- Time away from other content; having to work in

Student influences

- Student population, generational, cultural consideration
- Learning style/Learner type considerations
- Visual impairments

Skill influences

- Drawing skill set/abilities
- Visualization skills and abilities
- Design, layout, and organization skills and abilities

Adam discussed potential challenges that might influence the use of infographics in post-secondary education. Among these challenges, he mentions traditional instructional influences, instructor resistance and ability, and time challenges associated with an infographic activity. Most of the challenges and factors mentioned by Adam are in the teacher- and student-related categories.

Adam shared that using infographics might be negatively influenced by changing

teaching approaches away from traditional methods. He stated,

"If you are looking at disadvantages or negatives, people have been taught

differently throughout their educational careers so some folks may be used to traditional

outlines or traditional things and that may be the only sort of disadvantage that I can see."

Along these same lines, Adam said, "…People are often hesitant to change." . Adam

expands on this thought as it applies to post-secondary teachers and includes factors that

he believed might influence their adoption of an infographic assignment.

Instructor attitude, on if they, changing things is often looked at, also, this almost

[has] an artistic sort of flow to it, some of us, are very limited in how we visualize

things and once we see someone else do it, you know, we can see how it makes

sense, creativity is another aspect of that. - Adam

Adam adds that instructor experience with infographics and tendencies toward

existing teaching methods could also negatively influence use. He says "… my own

personal bias of how I was taught and how I have been teaching." as influences and adds,

"The only negative I see is just the limited experience from the instructor point of view

right now." He continues that lack of instructional experience combined with finding the

time to work in an infographic assignment into an already compressed course plan might

be challenging, he identifies these challenges and expands on the concept, "Their own

experience, time. Experience and time is primarily it. Further, "Time spent in the middle

of class yes, because we are under a certain amount of time for certain topics and, you

know, so we would have to crunch something else down to include development of

infographics."

Teaching infographics – Adam. Adam provides several teaching suggestions as seen in Table 10. Among these suggestions, he emphasized that it would be beneficial to use a process for teaching infographics, incorporating infographics progressively over a period, using a group strategy with a familiar topic and teach utilizing infographic examples.

Table 10

Teaching Infographics - Adam

Teaching Infographics - **Adam**	
Preparing to teach an infographics lesson (thoughts)	**Instructional practices (continued)**
• Realize that it may not go well the first time	• Use a process, model, approach
• Commit to planning and developing infographic components; commit to use	• Start small, simple, slow
• Develop a library/repository of infographic samples	• Demonstrate, work along with students
	• Address concerns students may have with drawing/sketching
Planning and preparation	• Use a common/familiar topic
• Time for learning/dealing with the learning curve	**Learner support**
• Take more than one semester, over a period of time, multiple phases	• Be available for students
• Evaluate how to adjust existing class to accommodate additional time needed	• Develop training videos, webcasts
• Significant part of course; commit to use	• Help students develop topics
	• Provide help selecting/refining information
Instructional practices	• Incorporate peer review
• Provide examples/samples	• Infographic about infographics
• Use groups	

Using a process. Adam shared that he thought it would be better to introduce the concepts of infographics progressively to students utilizing a process or approach that would develop over a period. He said, "I think it is all about experience too, it's not just a one-time deal and I have got infographics down, it would have to be a multiple step phase over a period of time." Adam thought that instead of presenting and teaching infographics in one session that it might be better to introduce the concepts in smaller sessions throughout the duration of the course. He explained,

The step process you know, several different things, come up with, maybe do it in

a sequencing rather than in maybe all in one whack, let's go through the whole

purpose thing, what do you find as the most important thing let's get these

purpose and start answering these questions so do it as a step by step process but

over a little period of time for the first one you know, introduce it in an

introductory class early and then you can build off of it.

Groups and topics. Another teaching practice suggested by Adam involved the

grouping of students and the initial infographic topics. He explains,

You could do it in a group settings, in an individual setting, something that is

familiar to them, you could assign the topic but yet make it a topic that is a

general basic thing about life, their favorite food, or anything like that and also,

work through one as a cohort in a class together, you know, and have each person

come up and contribute one item to it and develop it that way.

He adds that the topic used for the introductory infographic lessons could be

about topics or concepts that were familiar or common to students. He thought that using

a familiar topic would help to introduce the infographic concept without the burden of

learning new content at the same time students were learning to develop infographics and

provide what he refers to as "logical sequencing." Adam continued,

Well, yeah, and give it with a topic that everybody is familiar with. You know,

maybe, their favorite music, something like that. Some sort of a class project that

they are extremely familiar with, that they want to get information…tell me

something about you, so like a you infographic, or an infographic about me or

something.

Use of examples. Adam also thought that using examples would benefit the teaching of infographics. He said, "Yeah, the examples were really good. That was probably one of the best helps actually." He went on to say that having a repository of graphic elements would also be helpful, "Yeah, the process I went through was pretty good. I would say archive of symbols, emblems."

Developing infographics – Adam. Adam thought that in order to develop an infographic someone would need to understand the content displayed in an infographic, be able to logically apply critical thinking and creativity, and be able to refine, distill, and organize thoughts and then graphically communicate the thoughts so that others could understand the intended meaning and purpose of the infographic. Table 11 displays Adam's comments related to the theme of developing infographics.

Table 11

Developing Infographics - Adam

Developing infographics - **Adam**

Skills required

- Design, flow, visual considerations
- Ability to visualize and graphically represent concepts
- Challenges developer to be concise with thoughts
- Basic art skills/abilities
- Understanding of content
- Following steps to develop an infographic
- Coming up with an infographic topic

Other considerations

- Drawing over technology tools
    - Reason – allows for more freedom

Understanding of content, critical thinking, creativity, logic. Adam thought that developing an infographic required a good understanding of the subject and an ability to think critically about the content. Adam describes an infographic development skill set,

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"Overall general knowledge first off, creativity, again will be for anyone could be a challenge or difficulty, and sequencing, you know, understanding what processes go in what order and those type things are going to be kind of tough." Similarly he adds, "…you would have to have an understanding of critical thinking. You have to have some creativity, you have to have good knowledge of the topic…" Further, Adam shared that someone developing an infographic would need to logically approach the design to ensure that the infographic was useful, "The logic…yeah, good logical skills as far as you know, what needs to be included, making sure it is pertinent information, it's concise, and it's scannable and readable.

Adam emphasized the need for an infographic developer to be concise with their thoughts and mindful of the organization and visual layout of the infographic design.

It does challenge you to try to be more concise with your thoughts and develop something that can mean a lot of different things just from one little process. Also organization, you know, you really need to put a lot into the organization part of it, so the pre-planning is the most time consuming part to reach the final product.

He continued to emphasize the need for distilling information and being concise with the presentation expanding on the role of aesthetics in infographic design.

Finding out the information that is extremely pertinent to what you are wanting to get across so making things concise yet not losing the overall concept of what you are trying to present. You know I think the other thing is aesthetics when we look visually things have to be visually pleasing. Sometimes chicken scratch people don't realize that colorful formats, layouts, types of fonts all that stuff does play a role.

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Developing for an audience, visualizing concepts recognizable by others. Adam recounts his own infographic development experience sharing that it was challenging to develop a topic for a particular audience and then developing a visual representation of that topic that would be recognizable to others.

> The first challenge I had was creating that topic, what was an important enough topic that people would need to see an infographic on, and then trying to figure out what audience that I want to hit. Is it for a specific group? The other thing was coming up with icons that would be easily recognized, and then trying to make sure that I got my message across for those things, and then the other biggest challenge once I got the icons and those things was how did I want to lay this thing out, and even through this process I am still not sure that I am laying it out the best, it is something that I would have to keep going back and revisiting.

He explained further,

> The other thing was trying to create symbols and diagrams people would readily recognize. That was a little bit of a challenge but once you kind of got that then the layout process, that was another time consuming process just figuring out what would be the general layout, for the viewer what they would see how would they read it and making sure they would flow in the same direction that you wanted them to.

He revisits this concept and explains that a well-designed infographic can convey the information so that different people could understand and interpret the meaning of the infographic. Adam shared, "And everybody sees information differently. So if you can

create an infographic that multiple individuals with different viewpoints can actually see and follow then that is probably a good design."

Drawing vs technology tools. Adam thought that drawing the infographic provided benefits over using technology tools and application to develop an infographic stating, "Yeah, I think it would be a help, start with sketching." He added,

I think it leaves the creator a little bit more freedom to put it out you want, how you want it to look and flow. It also makes you have to really think about the information until it, you are creating something that the whoever the reader or audience will have a better understanding based on what you are trying to convey.

Adam suggested that the choice between using drawing or technology tools to develop an infographic would depend on the person but indicated that drawing-based approach might be the way to go.

It depends on the person. If they are a technology-based person, then, that might be what they like. If they are a step by step sequencing person that likes to get things down on paper first, that, the sketch process would probably be more for that. I would say that the majority of the population, the sketch process would probably be the better.

Infographics and learning – Adam. Adam described several learning impacts associated with infographics. He emphasizes the streamlining of information as a better way to communicate information to students; describes the critical thinking influences; discusses how infographics might help student remember information; discusses his perceptions about the value of the infographic to the learning process. Table 12 provides the concepts Adam mentions related to the theme *Infographics and Learning*

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Table 12

Infographics and Learning - Adam

Infographics and Learning - **Adam**

Emphasized Concepts
- Streamline information – condensing/organizing information
- Promotes critical thought, higher-level thinking, critical analysis
- Something different; another form of learning, new ways of learning/challenging students

Other Concepts
- Promotes in-depth understanding; perspective
- Reinforces learning; retention and recall; memory study/aid
- Meets needs of different learning styles; learner needs
- Promotes information checking/vetting/research skills
- Faster way to learn

The learning outcomes or benefits shared by Adam included the value of infographics in communicating information to students and the fostering of critical thinking. He thought that an infographic "May be a faster way to approach inputting information into your own head and also recall." Adam speculated that an infographic might be useful to share pertinent information to students interested in his program.

It did definitely provide me with a way to increase understanding from other people, like advisors and potential students because it is often a process that people overlook several steps so I think it will really improve their understanding and how they are going to go about getting in our program.

He also thought that the process of developing an infographic was dependent upon and grounded in critical thinking.

The whole process was critical thinking trying to figure out layout process, topic that is pertinent and important enough to put an infographic on then the information on that particular topic, that you would even, how you would branch

that off to really do an infographic to start with. So yeah, definitely critical thinking.

He added, "Yeah, I think it is an easier way to assess critical thinking skills too, because there are several different components of critical thinking that have to go into it, for the whole step process, planning process, not just the outcome of it."

Value of the infographic in the learning process. Adam describes how the infographic reinforces learning of materials emphasizing how the process of developing an infographic would benefit learning.

> Well it's another form of learning so they are going to have to go back and revisit the material so it's an additive or a form of memory recall and then areas that they are unsure about, they are going to have to go back and look that up to find out more about more information, make sure their information is accurate, organizational processes, anything that will require a process, or step by step process their going to have to go back and figure those things out – so that would be great for them to have to learn that. - Adam

He thought that developing an infographic might help students retain the information learned pointing out potential difference between visual and written communication methods.

> I think it would be good because a lot of our stuff is visual anyway, and sometimes it is easier to memorize things from a visual concept than it is from a written concept so if they can you know, try to recall things maybe some of those drawings or maybe they can even write it out themselves will help them recall

some different things that they had failed to remember just from seeing some of those symbols, diagrams, or charts, or flows, or whatever they were utilizing.

Assessing with infographics – Adam. Table 13 provides an overview of Adam's comments regarding the theme *Assessing with Infographics*

Table 13

Assessing with Infographics - Adam

Assessing with Infographics - **Adam**	
Thoughts about assessing with infographics	**Suggestions for assessment criteria**
• Good way to demonstrate understanding/provides assessment of learning • New way of learning/measuring learning, something different • Easier way to assess critical thinking • Use a checksheet (form of rubric)	• Depth of understanding displayed • Aesthetics • Logical flow • Audience considerations • Content independent of graphic quality
	Other assessment suggestions
Factors influencing assessment	• Peer reviews
• Grading challenges/considerations • Concerns about rubrics for grading • Instructor understanding • Unfamiliar to teachers	

Adam suggested some assessment benefits, provided thoughts on how to grade an infographic, shared a peer-based approach, and describes some challenges he perceived to be associated with grading an infographic. Among the benefits identified by Adam, he thought that the infographic would be something that a teacher could evaluate rapidly. He said, "I see that you can, people can, it makes it very easily processed, very quickly processed without having to do whole lot of reading so you can read it real quickly." Adam thought that an infographic could be assessed using a form of rubric he refers to as a 'check sheet'. He also provides insight into how he might utilize this checksheet for student feedback.

I would have a check sheet with points awarded for each section with a comments section that how to improve, not just how to improve but also what was good, because people often tell you how to improve but they never tell you things were good so you know to say well let's keep utilizing that.

Assessment criteria. Adam provided an overview of possible assessment criteria for an infographic sharing that along with elements of content that the student could effectively convey their learning.

Yeah, because you can see, did they get the major topic that you are really trying to present, did they understand exactly all the different things that would be effected by it or go into it and are do they can convey the information in a logical process to show that they really have a good understanding of it.

He also shared details about assessment criteria providing insight into how the infographic could be assessed suggesting,

Well, as far as method goes, probably I almost like the step process we utilized you know, making sure that the subject is relative and important enough to do then the sub topics that were developed you know, were they the appropriate subtopics, were they well thought out, well organized, was there any sort of sequencing, also, with that, one of the biggest things I kept saying was the flow make sure that it is a logical flow process and that it catches the eye quickly and can be followed by the eye quickly, and then also, any information that you really want to get in touch with the audience, did they go a good job about putting it in something that would capture the eye quickly?

Among the assessment criteria he shared, Adam thought that an infographic should not be assessed on the graphic quality but rather on the learning conveyed by the infographic, Content over graphic, "No, not really, because I don't know that it is, you know, I wouldn't see it as much of an art class as much as information and understanding the concept portion of it."

Peer reviews. Adam offered that the structure of peer reviews might provide an added benefit by affording students to evaluate each other's work and in the process help them learn more about how to develop their own infographics. He said, "Also, I think that having them do peer reviews of each other's infographic is going to make, is going to lead them to questions of saying, well, I wish they had this in it which will help them develop their process better."

Assessment challenges. Adam suggested that students might be better at developing an infographic than their teachers. He thought that this might create a challenge for the teacher at least until the teacher learned more about infographics.

> I think instructor's knowledge are limited with the process itself so actually providing a fair assessment of that student you may actually have a student that is better at it just because the generation they have grown up in, better at it than the instructor. So until, you know, instructors themselves are better at it, it would still be a building process.

Participant Viewpoint - Becky

Becky has been a post-secondary teacher for 13 years. She is an Associate Professor teaching within the Business and Professional Services academic discipline. Becky has a Masters degree. Becky has experience teaching

infographics in her classes and has utilized infographics assignments in her courses.

During the research study, Becky designed an infographic about concepts fundamental to a course she teaches. The purpose of her infographic was to communicate these fundamental concepts to students and to provide a general overview of the concept. Becky's infographic is displayed in Figure 18.
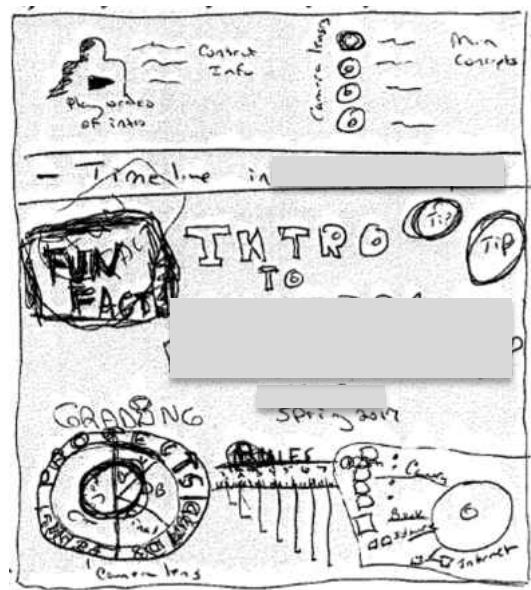
Figure 18. Becky's infographic

Figures 19 and 20 graphically represents the comments that Becky shared with me during our interview. When her comments are grouped within the key themes of the study we see the areas that she commented about and emphasized regarding the infographic development experience.
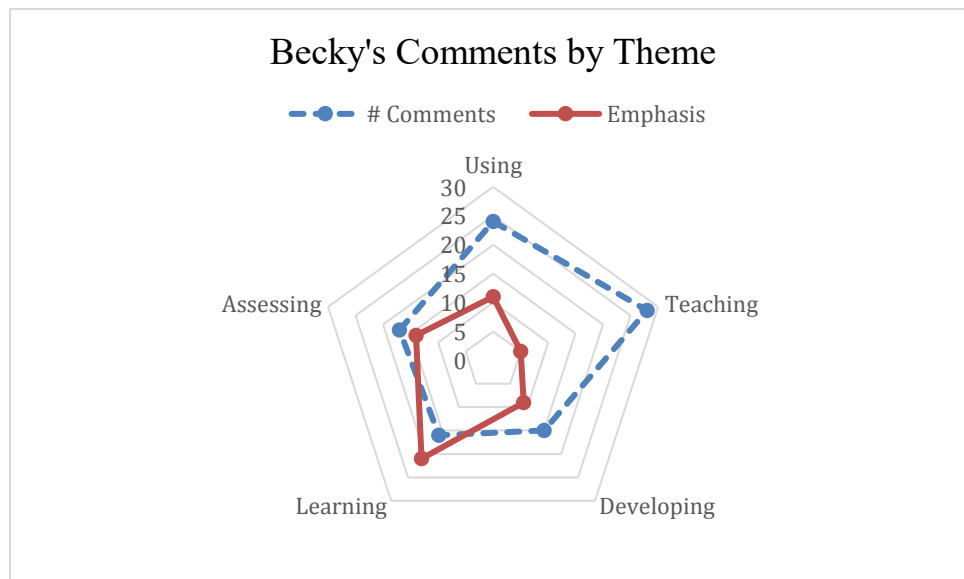
Figure 19. Becky's comments and emphasis by theme – radar chart. The dotted line in the figure represent comments made by Becky related to the themes of this study. The solid line represents areas that Becky emphasized.
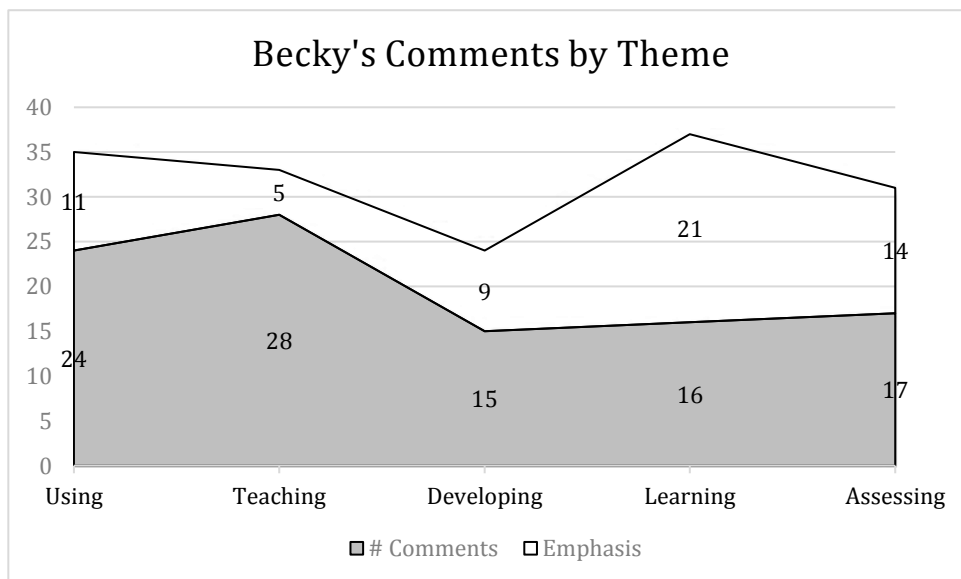
Figure 20. Becky's comments and emphasis by theme – area chart. The area at the bottom of the graph displays comments made by Becky related to each of the study themes. The area at the top of the figure provides additional comments made by Becky emphasizing comments and themes.

I classified Becky's overall experience as L-U-T-A-D based on the comments she made and the emphasis she placed on the concepts that make up the key themes. Table 14 provides the number of comments Becky made and the times she emphasized concepts within each of the key themes of the study.

Table 14

Becky's Comments and Emphasis by Theme

	Theme	# Comments	Emphasis	Total
L	Infographics and Learning	16	21	37
U	Using Infographics	24	11	35
T	Teaching Infographics	28	5	33
A	Assessing with Infographics	17	14	31
D	Developing Infographics	15	9	24

The following sections provide detailed information about the concepts Becky mentioned during the interview along with an overview and specific responses that she shared. Becky was only one of two participants placing emphasis on the learning aspects associated with infographics. If we look at the areas she emphasized, we see that she provides most of the emphasis to the *Infographics and Learning* theme. This is followed closely by the *Using Infographics* theme, the *Teaching Infographics* theme and the theme *Assessing with Infographics*. The *Developing Infographics* theme received less emphasis. I wanted to point out these areas of emphasis because it provides another level of detail exploring how Becky perceived the infographic development experience.

As depicted in Figure 20, we can see that although Becky comments on concepts associated with the theme *Teaching Infographics* the most, she places more emphasis on the themes of *Infographics and Learning* and *Assessing with Infographics*. This emphasis is followed closely by the themes *Using Infographics* and *Developing Infographics* with

Teaching Infographics being the theme emphasized the least. Table 14 provides the total number of comments Becky made during the interview by theme. Table 14 also shows the emphasis she provided within each theme.

Infographics and learning – Becky. Table 15 provides the concepts mentioned by Becky regarding the theme *Infographics and Learning*. The concepts mentioned help to develop an overview of the thoughts and insights that she shared regarding her training experience. In this theme, Becky focused on the student learning associated with the infographic development process, teacher learning and instructional influences associated with developing infographics, and discipline-specific learning considerations.

Table 15

Learning Associated with Infographics - Becky

Infographics and Learning - **Becky**	
Emphasized Concepts	**Other Concepts**
• Promotes critical thought, higher-level thinking, critical analysis	• Find connections in content, conceptualize a topic, identify patterns
• Promotes in-depth understanding; perspective	• Stimulates engagement; encourages attention; students connect with this more
• Promotes visualization skills; visually communicate understanding	• Reinforces learning; retention and recall; memory/study aid
• Infographics as a teaching activity (students - teach to learn) also (teachers - learn to teach)	• Fosters creativity and imagination
• Lots of information in a small area/condensing/organizing; chunking information	• Encourages thought, deeper thought; rethinking
	• Promotes information checking/vetting/research skills
	• Great way to learn, helpful
	• Faster way to learn
	• Useful tool
	• Way to make classes better; cutting edge way to improve classes
	• Helpful to teachers; informs instruction; sensitive to learner needs

Student learning. Becky reflected on the learning outcomes associated with the infographic stating, "What you have here is that you are really making people stop and think and focus you know, she added, "I can see this as definitely becoming a huge thing…." Further, "I think I kind of already knew you know what an infograph was and that how useful they could be, maybe I didn't realize the, the extent of how useful they

could be, of how much information you could include on one sheet. She implied that infographics could be used for more than design practice, "I never really thought about doing infographs in the class before, for the student's benefit, you know, other than just have them design it. But yeah, I can definitely see how this could help a lot." She also suggested that the process of developing an infographic needed to be experienced to fully realize the impacts to learning offering,

> I think people, a lot of people will not appreciate this as much until they go and try just do an infograph on their own, you know, it's like, oh, okay I'm going to go and design an infograph, you know. - Becky

Becky also reflected on the learning occurring during the development of the infographic.

> Well, they're going to have to do research because they're going to have to figure out, you know, they're going to have to get their data together…so the student is going to have to go out and look at different areas and read different articles and figure out…they're going to have to do a lot of reading and assessing that information… You're going to have to you know, take that information and figure out what's the best way to present it on that one sheet of paper to get your message across you know, to help someone else to understand.

She added "In something like this you know, it's either they got it or they didn't, you know, it's stuck in their head or not. Becky continued talking about how the process of developing the infographic influenced learning stating, "Anytime you're drawing something or even if you're just writing it out you're going to remember it better than you are from selecting a, b, c, or d."

Teacher learning. Becky shared that the infographic development experience could benefit the teacher as much as the student by providing teachers with a way to improve instruction, "…kind of is teaching them how to teach." She stressed that the process of developing an infographic would help to refine the presentation of information to students explaining,

> Yeah teaching to learn, that, that is true but, I don't know, in this, it's almost learning to teach though I mean because you're learning how to present information to someone else to make it easy for them to understand and that's what a teacher does, that's what a teacher should do anyway. They should be able to take information that is not something that's easily grasped on your own and you know turn that around, or you know, show that in some way, some fashion whether it's an infograph or whether it's through projects, or whether it's through tests, or maybe just a culmination of all that, you know, and help the person to understand that data.

Discipline-specific learning. Becky thought that students in her program needed to know how to develop infographics. She explained,

> They [students in Becky's program] have to know how to do that because my students for instance, these are becoming very popular, I mean, so, I think they're going to see that a lot in their workplaces, you know, they're going to be asked to design these, you know maybe not everybody but some will and they're going to need to know how to, you know, cull through that information, and it may be information they know nothing about, and they're going to have to figure out what is the most important piece of information here that I really need to, you

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know, focus on, and to make, you know, put in a hierarchy fashion you know, where do I start and so I think starting at a basic level like this and building up from there is going to help them through that thought process.

Using infographics – Becky. In this theme, Becky focuses on the discipline differences that might influence the use of infographics in post-secondary education. She also emphasizes the time and effort required for an infographics activity and the appeal that this format might provide to the next generation of learners. Becky also provides examples of how infographics might be used and discusses challenges that she believes might influence the use of infographics. Table 16 provides an overview of the potential uses of infographics that Becky shared.

Table 16

Uses for Infographics - Becky

Infographic Uses - **Becky**
• Presenting information, communicating information
• Projects
• Critical thinking assignment
• Syllabus
• Course planning, organization, outline, prep
• Design practice
• Activity to inform teaching (learn to teach)
• Used as an alternative to existing assignment/alternative assignment

Why use infographics? Becky shared that she thought that students today may be experiencing information overload and that infographics might provide a way to assist the learning of new information. She commented, "I think kids today are just overwhelmed with information and to be able to just look at one thing and gain a lot of knowledge from that is going to help them in their education." She expands on this thought describing the characteristics of an infographic,

I've often noticed this, I don't like a lot of fluff, you know I don't, when, when I'm finding out information I just want to know the information. I don't want to know all the little details and stuff about things like that, just give me the main points and let me go from there because I'm probably going to forget all that other stuff anyhow. I like the infographs because of that.

Use in a variety of disciplines/classes. Becky thought that infographics could be used in all post-secondary disciplines stating, "Absolutely. All of them, I can't, again I can't think of a discipline that it wouldn't work in." She mentions that although it might be applicable in all disciplines, she thinks that some disciplines might not be as enthused with the activity.

I can't think of a, a discipline it wouldn't work in and any of the hard techs it would work, welding, electricity, you could definitely find information there to do an infograph on. Now I don't think that everybody is going to be as excited about it [laughs] as maybe I am but, you know, I don't see the Diesel guys excited about doing an infograph but maybe they will you know, I don't know.

She talked about the use of infographics both in terms of post-secondary disciplines and discusses the potential for secondary educational application.

I just don't think there's anything that they, it couldn't be used for and not just post-secondary, you know, I think, I think, you know, maybe the lower, elementary classes would be kind of hard for them to do that but once you got into you know, junior high or high school, I think that would be you know, a good, a good time to really start students doing things like that you know building up.

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Along these same lines, Becky suggests that infographics might also be a way for a post-secondary program to attract students seeking new, innovative ways of teaching and providing information to students. Attracting those students seeking the 'cool factor' in post-secondary education. She uses the example of providing a syllabus as an infographic.

> And not only is it, is it just good for the students, I think it's good for the program because it shows that you're a little bit [pause] I don't know if it's higher tech or if it's just more forward thinking, you're just, you're kind of going more with the trend, changing the way education is, perceived. - Becky
>
> Right now I'm just sending them a basic syllabi, but if I could send them an infograph, I really think that that would help, be a recruiting tool, because they would be like oh wow, this is really cool, and it's said that education has came to that, but that's what a lot of students are looking for, you know, that's what a lot of prospective students are looking for. - Becky
>
> They're always looking for the cool factor. They want to you know, go someplace that's cool, and I think sometimes that hurts our college, you know, because we don't have enough of that cool factor but things like this [the infographic] help us to be more perceived as you know, a higher learning institute or where, I don't know they, they just look neat, it's good for the students and they just look at it and say wow, you know, that's so much different than a regular syllabus. - Becky

To inform teaching. Among the potential uses, Becky mentions the use of infographics as a way for teachers to gauge their instructional effectiveness and a means

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to inform instruction. This is a recurring concept that Becky mentions also in the "Infographic and Learning" theme.

> Yeah, absolutely, I mean because [laughs] if they all turn in very poor infographs then you're like [laughs] well, I think I might have failed them, you know, and you go back and revisit the areas that they're all lacking in.

As a student resource. Becky thought that students may value an instructor-developed infographic more than other reference sources.

> Yeah, chunking information to the students, you know, just again, removing that fluff and giving them the main points that you know they can visually look at and they can easily pull it back up and look at it you know, it's not like having to reference a certain point in a book, or having to reference an article online or anything it's just you know, a nice laid out document they can just save and pull it up and look at it. And it's going to be something they're going to want to save because it's got a lot of information in it, where an article might only have you know two or three high points in it, you know, but an infographic could have you know a lot more than that.

Factors influencing infographic use - Becky. Table 17 provides an overview of the concepts that Becky perceived as being factors that influence the use of infographics in post-secondary education. Of these, she emphasized the time challenges associated with an infographic assignment, learning style influences, and teacher resistance to using an assignment like an infographic. An attempt has been made to list and expand on these concepts exclusively but some concepts span the categories.

Table 17

Factors Influencing Infographic Use - Becky

Factors influencing use of infographics in post-secondary education - **Becky**	
Teacher influences	**Student influences**
• Teacher not open to trying something new • Instructor understanding content enough to develop infographic • Instructor knowing how to follow steps to develop infographic • Extra work involved • Teachers may not see benefit/value	• Student population, generational, cultural consideration • Learning style/learner type considerations • Students not familiar with infographics • Students may not grasp concept of infographics easily
Curriculum influences	**Skill influences**
• None provided	• Drawing skill set/abilities • Visualization skills and abilities • Design, layout, organization skills and abilities
Time influences	
• Takes time to learn (learning curve) • Time and effort required	

Time influences. Becky comments that the time challenges associated with using infographics in class may pose a challenge indicated that the additional time "would be a factor." She thought that this time-related challenge would impact the student maybe more so than the teacher, "Yeah, I think so, maybe more so on the student side because it depends on how much other material you're already giving them…" She also mentions challenges she perceives for teachers relating to the extra time it might take to design an instructional strategy that would include infographics noting the time for developing infographics, grading the infographics and the challenges associated with using this new form of instruction. She suggests other challenges facing the teacher including the ability to visualize and design an infographic.

> The grading of it, having the time to come up with these, to you know, coming up with the concepts for them, coming up with the design for them, because, you know, it would be a little time-consuming, the good thing of it is is if it's not

information that changes a lot you know, you would have that from one semester

to another, so if you could just design like one a semester or something or two a

semester, you know, you could you know, eventually come up with you know,

several of them to have, you know, to pull from but, and then the design of it, you

know, just designing it because, you know, maybe some, and here I go again on

the math people, they may be great designers, I don't know, but I would think you

know, like for the most part, some of them may have some problems with, with

the design aspect of it, not the data part of it, I think they could probably pull that

out with no problem you know, and, but, taking that data and presenting it well

they might have a little problem with that. And then some, some of the teachers

may have more of a problem with pulling the data out, maybe they have so much

that they can't figure out what's more important.

Learning curve to teach infographics. Becky thought that the learning curve

associated with the infographic might influence the decision to use infographics in the

classroom. This learning curve she describes, includes the time needed to teach students

how to develop an infographic and mentions that students may respond differently to an

infographics lesson.

I think the factors going to be the ability to do it, you know, the learning curve for

it, not saying that they're really hard to learn but, I guess taking the time to teach

the students how to do one and then, I don't know that all students are going to

grasp it real easy, you know, I think that's where our students [students in

Becky's program] hopefully have a little bit of an edge on that, but your math

students maybe not, you know, because math people a lot of times they think a

little differently than you know, it's not a visual thing for them, they're more logistic and to be able to sketch something out, to sketch what they're thinking out is, it might be a little tougher for them.

Teacher-related factors. Resistance from teachers is a recurring concept for Becky. She describes that some teachers may be resistant to an infographics assignment for a variety of reasons and factors. She explains,

I mean we have teachers that are not open to teaching online you know, so I think we would have teachers that are not open to doing this just because it's different and it's not the way that they were taught, and they don't see the point in changing their curriculum at this point in their life because they only have so many years till retirement and there's just no sense in putting forth all that extra effort to develop that, you know. And then I think, even some of your newer teachers, you know, they may not see the benefit in it. I see it, very easily and so I have difficulty believing that nobody, that there would be anybody that could say, you know, there's no benefit in that, there's no need in doing those. But I'm sure there's probably going to be some that would say that but I wonder though if it, if it's more because of the work that's involved in doing it, you know, cause a lot of people don't want to spend that extra time doing things like this, they'd rather buy the material or get it off line or you know.

Teaching infographics – Becky. Becky provides a wide range of concepts related to the teaching of infographics. Becky is one of only two participants in this study that has experience using infographics in a class activity. The concepts mentioned by Becky for teaching infographics are listed in Table 18.

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Table 18

Teaching Infographics - Becky

Teaching Infographics - **Becky**

Preparing to teach an infographics lesson (thoughts)
- Teacher should understand how to develop an infographic
- Develop a library/repository of infographic samples

Planning and preparation
- Provide time for practice
- Need time to learn before teaching someone else
- Time for learning/dealing with the learning curve
- Develop repository of infographics for classroom use/colleague use, different subjects/disciplines
- Determine whether to provide data or have student research data

Instructional practices
- Provide examples/samples
- Use groups
- Use a process, model, approach
- Start small, simple, slow
- Allow for revision, flexibility, freedom to create
- How it is introduced

Instructional practices (continued)
- Use labels to offset drawing limitations, written portion to explain
- Challenge students
- Delay sketching until later
- Use a common/familiar topic
- Establish a non-threatening environment
- Address concerns students may have with drawing/sketching
- Explain role of drawing/sketching; not about graphics
- Delay judgement, don't expect perfection, permission to screw up

Learner support
- Don't just introduce without support
- Provide students with design template, design options
- Be available for students

Training environment
- None mentioned

Of these concepts, Becky stresses the importance of teachers understanding how to develop an infographic before teaching the subject to students. She also recommends the use of a process or model to guide the instructional process.

Teacher needs to know how to develop. Becky reflected about a class where she utilized an infographics assignment. She admitted that her students struggled with that assignment. She references that assignment herein and reflects that having more teacher training on infographic development might have helped.

> Because I think my thing was, I was just pretty much you know, I just kind of threw it at them [infographics assisgnment] and, it's like here, I want you to create an infograph, go online, look at these you know, here's your data, and do this, you know..

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She continues,

> If I had been trained on it more myself [how to develop an infographic] before I
> gave it to my students, I would understand that they really need to learn, you
> know to grasp some of these early ideas before, you know just putting them out
> there to, you know, swim, maybe they need to learn how to do the breaststroke
> and things before they start swimming [laughs].

Using a model/process/approach. Using the infographic assignment that
she used in class, Becky continues to describe the advantages of using a process
or model when teaching students how to develop an infographic. She relates her
own experience with the model used in her infographic development experience,
"It really worked, it helped me think about things that I wouldn't have otherwise
thought about." She expands on using a process or model to guide students
through the development of an infographic

> Absolutely, I mean, I think this would, you almost have to have something like
> this, I mean, I'll go back to the [course] project you know, I didn't have
> something like this and the project did not go over real well it was hard for the
> students because they were hung up on culling that information out, you know, I
> guess actually what exactly are we looking for you know, how much do I put in
> the infograph you know, and, and how do I present that, I guess the main purpose
> of it maybe even, you know, just what is my main purpose of this infograph.

> Becky describes how a process or model like that used in the infographics training

would help students develop an infographic.

It [infographic development model] would have gave them more structure in what they were supposed to be creating. You know, I was more on the technical side of it, you know, I want this, this, and this you know, and pull it from this data, you know, or if you don't want to use that data find me some more data and I will approve that, but it was, so it was more on the aesthetics of it you know, how it's going to look instead of the content of it but I can see using a model like this for the content you know, the aesthetics of it, it's the basics of it, you know, the layout and stuff.

Assessing with infographics – Becky. Table 19 provides the concepts that Becky mentioned associated with the theme *Assessing with Infographics*. She emphasizes the authenticity of using infographics as assessment, comments on the general value of infographics as assessment, and discusses the importance of assessing the content of the infographic and not the quality of the graphics. In Table 19 displays an overview of Becky's insights regarding infographics and assessment. Her primary areas of emphasis in the theme are the benefits of using infographic as an alternative to traditional exams.

Table 19

Assessing with Infographics - Becky

Assessing with Infographics - **Becky**	
Thoughts about assessing with infographics	**Suggestions for assessment criteria**
• Good way to evaluate learning/demonstrate understanding • New way of learning/measuring learning, something different/alternative way of assessing • More authentic assessment of learning; hard to fake/cheat • Assessment of teaching/inform teaching/formative assessment • Really have to think • Benefit student more than regular exam • Use a rubric	• Depth of understanding, key concepts clearly communicated • Level of detail, specific facts • Aesthetics • Content independent of graphics/artwork ○ Graphics quality might depend on subject **Other assessment suggestions** • None provided
Factors influencing assessment	
• Grading challenges/considerations • How to grade fairly • New way of assessing, unfamiliar to students	

Used for assessment. Becky discussed her perception about how infographics might be used as an assessment indicating that her thoughts had changed during the training. Becky current use of infographics was mainly design-oriented. She would provide her students with the infographic data and ask them to develop the design of the infographic. She explains that she realizes that when students actually develop the infographic, including the collection of data, that the infographic could be used as an assessment of learning. She describes her thoughts on using infographics as an assessment.

> Well, I've been thinking about using that as an assessment and at first I was like, how would you use that as an assessment, that, you know, I was like, I don't, I don't think you could do that, you know, but then, actually you could because it's just like they have to create the data themselves you know, instead of pulling it from somewhere, you know, like I don't know, maybe you could do a mid-term

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or a final or something you know, creating an infograph of what you've learned in this class.

She added that she thought infographics would be a good way to evaluate the critical thought occurring in class,

Another thing that would be good to assess on these is where the critical thinking component that we put in a lot of our classes is the main question, what's the main thing you got out of this class. - Becky

More authentic assessment. Becky thought that infographics might provide a better, more authentic assessment of student learning and benefit student much more than a regular exam. On several occasions, she compares the infographic assessment to more traditional, objective assessments such as multiple-choice exams adding that an infographic would require more thought. She offers,

That [infographic] would make them think so much more than just a regular, you know, multiple question exam's going to do, because, you know, they're just going to use deductive reasoning on the a,b,c, or d, you know, which one sounds like it might go best [laughs], you know, where if you are actually, it's, it's like the difference between a fill-in-the-blank and a multiple choice, you have to really think about a fill-in-the-blank you know, the answer's not already there for you to choose, you have to come up with it. So I think you have to think a lot more about that and understand your subject a lot more.

Becky expands on the concept adding her own experience while developing her infographic.

This is better than a multiple choice question you know, it's, it really makes the, the student think, it makes me think, you know, anybody who has to do one of these it's going to make them think more about the subject than what they would think about in a standard, you know, question test. It's you know, except maybe fill-in-the-blank, you really have to think about those [laughs].

Becky related in this theme and in the *Developing Infographics* theme that designing an infographic assignment might take time but she thought that the outcome was worth the effort.

You know so that's, that's going to be more time consuming because I'm going to have to set it up then I'm going to have to grade it, I'll to have to create a rubric and go through and grade each one of them [laughs] so that you know, that could be a little downfall from it but other than that, I think it would benefit the student way more than doing a regular exam.

She continues,

But the benefits of it I think far outweighs that because you would be able to really see what the students are learning and see where you are lacking. See where you're lacking in your teaching and what you need to be working on to help the student to better understand the material.

As an added benefit, Becky suggested that the infographic, "would be more interesting to grade, you know, than your regular test."

The following comment from Becky sums up many of her thoughts that she shared with me during the interview. She touches on the benefits of using infographics as

an assessment, provides examples for use, and describes learning and instructional outcomes associated with an infographics assignment.

> As far as the way it's influenced me is thinking more of getting rid of quizzes and having assessments that are based more on what the student really knows instead of what's the best way to answer this question you know. I just don't think, I'm just never been a fan of your standardized test because, it's easy, well it's not easy but, it's easier to guess the right answer than to really show that you know that information, and by creating an infograph you have to really show you know that information and in doing so, even if you don't know something at that time you learn it you know, as you're putting it into that so, it it's you know, it helps them to go back and reflect on everything they've learned you know, in the class and if you're doing this like a final you know, to help them, you know, say what did you learn in this class, helps them to look at every, go over everything that they've learned or at least look at it you know, maybe not go through it thoroughly but look at it and pull out the most important things to them that they learned plus it also helps you to assess what you were able to teach them.

An assessment of teaching. Becky thought that the infographic could be used not only as an assessment of student work but also as an assessment of teaching. She suggested that the student infographics might provide teachers a way to assess their instructional effectiveness. She said, "The only things I'm not sure it would assess them more or if it would assess my class more [laughs] I think it would probably be more of an assessment of the class than it would be…" She continued, "If they come up with you know, some key concepts but they're like way off base of what they should be I don't

know how you would grade that because that's what they got out of the class so I mean it's not really their fault you know."

***Grading challenges*.** Becky shared that the grading of an infographic might pose challenges. These challenges involved being able to grade the infographic fairly and the time associated with the grading process.

> Being able to grade it, being able to grade it and look for that certain set of information. I guess choosing it to begin with, creating that rubric, that's something that students don't have to worry about. And grade it in such a way you know, that it's fair across the board, but yet, also it shows whether they are really learning it or not, just, not just the technical side of it, not, they included the three key concepts you know, but how well did they show that.

Becky also suggested that the infographic might require more time to grade compared to assessments that can be graded quicker.

> So you've got, you know, thirty, sixty, ninety assessments coming in and you're having to grade all them and get that grade turned in in time it's a, it's really hard so that's where you want to go back to those multiple choice questions where they're grading it, you know, Blackboard grades itself but I don't want that to be a con for it, but in a way I think it could be you know. If you're using it as a final but now if you're just using it as a regular exam, I don't see any problem with that other than it would create a little bit more work for the instructor to grade it.

***Using rubrics and criteria to assess*.** Becky suggested that she would use a rubric with specific criteria to assess the infographic.

I would probably use a rubric because you'd have certain information that you'd be looking for. I guess if would be different if you assign them the data. Then you know you could you, could be more specific as to what exactly you're looking for but I guess you generalize it too though, if you're looking for three main, key concepts you know, and then, what are the smaller concepts that go, that tie in to those, do you have any of that and do, is it easy to read, does it flow well, do you have any information on there that a person has to, you know, think about, or is it just something they can just look at and, and obtain that information and then, on the technical side of it, you know, like I would probably have, you know, width and height, you know, how many, what the resolution should be, and what the color scheme is and you know.

She continued, "There would probably be a part in there about you know, how aesthetically pleasing it is, you know, is it, is it something that people are going to want to be interested in looking at." Becky also thought that the infographic grading rubric should be given to students before the activity to communicate instructor expectations. She said, "I think it would be important to give them that rubric too beforehand so that they know, you know, what points that they need to include in on that infographic in order to get the best grade." Becky shared thoughts on criteria that might be included in an infographic grading rubric indicating that different criteria might be used depending upon the subject area stating, "Yeah, I think you would just, I think you would have to be a certain design differently you know, for artistic versus factual-based classes." She continued,

In my discipline yes, I think so. And that's like what I just said, we could grade on

the technical aspect of it, the content aspect of it, I think, it might be a little bit

harder for us as far as that goes, but easier for some other disciplines, you know,

history or science, or math, or something like that, that is more, more factual you

know, instead of, artistic. I think it would be a whole lot easier to grade an

infograph as a form of assessment in those disciplines, but ours is artistic, it's like,

it's in the eye of the beholder, you know, you've got to really focus on the

technical aspect of it.

Content more important than graphics quality. Becky emphasized that the

content of the infographic was more important than the quality of the graphics included in

the infographic providing a distinction between instructor- and student-use infographics

and the influence of course type.

You're just wanting to see if they know the information and how well they're able

to relay that so, yeah, I mean, I think, it's getting past that point of, I don't care

what you're drawing looks like, you know, it's okay if, if it's, if you can't

understand it by looking at it the next day after you drew it, put me a little note in

there telling me what this is, you know [laughs].

She adds that even in a visually-focused discipline like her own, students need to

be able to develop the content for the graphics they develop.

We all get hung up on the aesthetics of it you know I mean but, yeah, I think it's

more, the content's more important it really is, for the most part. In my area again

it's going to be visual, but still, even if a [student in Becky's program] thinks that

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they're never going to have to come up with that material it's going to be given to them, I mean, they're, they're grossly mistaken, it's not [laughs].

Differences between instructor and student infographics. Becky provides comments related to how an instructor's infographic for communicating information to class might be different than the infographic designed by the student. She also reiterates her position that the content should be the primary focus in terms of what to assess on the infographic. She mentions here a distinction between the assessment of the graphics in terms of teacher use and student use of infographics that is covered later in this section. She stated, "Especially on the student side, I don't think it should be about the drawing." She provides a distinction between student-created and teacher-utilized infographics,

Yeah, what we just said, I mean it's, I think it goes back to the content's more important so, if it's sketched I think that's fine. I think if you're using it as, if you're a teacher and you're using it as a model, then I think it might need to be, you know, have detail and color and you know, be more beautiful, but, if, if you are actually using it as an assessment I think it shouldn't. I think you should be basically just sketched out, and because you don't need to be dwelling on what colors you're going to use or you know, how, you know, is this balanced, and is this symmetrical and all that, I think, it just, in some ways you've got to think about your layout because it's got to be something that's going to be easy to view, easy on, easy on the viewer's eyes, you've got to be able to still pull them in you know, make them want to look at it but still more so the content of it, it's how much do you know.

She points out that in some classes, like her own, there will be a component of the assessment that is based on the graphic because of the subject matter and that this might not be a requirement in other classes.

> In my class it, it is, it's going to be, there's going to be a technical side to it that's going to be about the drawing but in all the other classes, there probably, probably shouldn't be, it shouldn't be about what it looks like at all other than is it easy, you know, to conceive the idea.

Becky relays that the training experience helped her learn that the content of an infographic was more important than the graphics the infographic contains.

> I think that's what I'm taking away from it, is that that's more important, and, and, and that the content is more important than the way it looks, I think that's the biggest thing that I've took away from this because, I, before I've always looked at infographs as, oh, that's really cool looking, you know, and I think that is a big part of it in a way, if that's the way you're using it, to display information if you're using it display information then I think it is important that it, it has that cool factor that pulls you in. But if you're using it to assess information then I don't think that it's that important at all. So that's one of the biggest things that I've learned about that.

Developing infographics – Becky.   In this theme, Becky focused on the design and visualization challenges associated with developing infographics. Table 20 provides an overview of the skills and other development-related considerations shared by Becky. She recounts a process of developing infographics that begins with an understanding of

the subject and works through the challenge of converting that understanding into a visual form that can be interpreted by others.

Table 20

Developing Infographics - Becky

Developing infographics - **Becky**

Skills required
- Ability to visualize and graphically represent concepts
- Basic art skills/abilities
- Understanding of content
- Following steps to develop an infographic
- Design, layout and organization skills
- Logic, deductive reasoning
- Research skills
- Select and use appropriate data
- Technology skills

Other considerations
- Drawing over technology tools
  - Reason – as a design aid
  - Reason - content's more important than graphics
- Technology tools over drawing
  - Reason – program/course type
  - Reason – more professional presentation

Infographic development skills. I asked Becky what skills she thought someone developing an infographic should have. She emphasized the ability to 'teach' and 'relay information' to others in a form that is understandable, being able to understand the needs of the audience. She explained,

> Research skills and then deductive reasoning, you know, what's, what's going to be the most important things, maybe not really teaching skills, but I guess teaching skills in a way, I don't know what you would call that but just being able to relay information to someone else that's easily understood, having that ability to, to put yourself in the viewer's, you know, seat and think, you know what is it that I would like see, what is it I would like to get from this, and does this make

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sense to me seeing themselves on the other side of it and then the design thing, you know, being able to design it.

Subject knowledge. In addition, Becky thought that infographic development was depended on student knowledge about the subject, "It could be knowing a lot about the subject or not knowing a lot about the subject." She elaborated further stating "So I guess it depends on how much they know about it, is what's, you know, might be their hang-ups on that." She shared her own struggles with organizing the content, "That's where I had my biggest problem was like what little things, you know, what big things, what key concepts and then what data emerges from that and deciding where to put everything. The organization of it, I guess.

Visualization challenges. Understanding the subject and being able to communicate that knowledge to someone else might be challenging as Becky describes; pointing out that visually communicating information is different than communicating information in written form.

> I think that is how it's a little different than just the written work because you know, written is more factual, you know, just put it down there and it stands on its own but when you have to go with visual, then there's so many different ways of presenting the same thing and some of them work well and some of them don't work well in different situations so what might work well now, won't work well on something else but you just have to figure out your audience and you know how best to give that information to them so I think that's probably going to be the student's biggest hang-up, my student's biggest hang-ups anyway.

Becky continued to describe a challenge she perceives people have when it comes to visually communicating ideas.

> A lot of people, you know, they don't, they don't understand that, they don't know how to go from you know, this general idea about something and breaking it down and to creating something visual. You can do that written, most teachers could probably do that written with no problem but visually, they don't think of it that way.

Becky suggested that ability to visualize data might also be influenced by innate student abilities and be manifest within specific subject indicating that students in certain disciplines might be better at working with the data and visualizing data than others.

> Well, artistic abilities as far as math people go, I think as far as taking that data and culling it down the way it needs to be, they'd probably be better at it than the artistic people; you know and then the artistic people are going to have problems, you know, doing that part.

Design challenges/drawing challenges. Becky also thought that student ability to design and draw would compound the information visualization challenges.

> Not knowing how to draw is a big hang-up for people, it's a real thing, it's a real struggle; you have it in your head and you want to put on the paper but it just, when you put that pen to the paper it just doesn't work right.

She describes her own experience,

> Drawing for me was a, was definitely a thing and I think it's getting them through that point like what you did with us, you know, don't let it be a hang-up for you,

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just sketch it out and put labels on there you know, and, and practice with the little simple drawings and things like that.

Overcoming challenges associated with drawing infographics. Becky not only shared the challenges she perceived with drawing infographics but she also offered advice on how to teach to these challenges.

Yeah, I think it could be a big hang-up for them, I mean, if they, you know if they think they have to draw it may just deter them from wanting to do it all, but that's where I also think that you know, teaching them from the ground up like what you did here is, is very important too, you know, because you're letting them know, I'm not looking at your drawings, it's kind of like what I do in the, in the [class she teaches] class you know, I, that's, that's a completely sketch-based class and I let them know up front, I, I can't draw either so I'm not looking at your drawing I'm just looking at your ideas you know, so if you just make the pictures well enough that I know what you're talking about, you know, that's fine and I have them use words on there too, labels or, you know, put a little blurb out beside of it what you're trying to show me here, make a little box you know with squiggles in it for the text, the text is going to go here, or, a box with an "x" that's where the pictures are going to go, you know, and things like that.

Becky continued,

For a lot of people, the design part of it might be a hard thing for them, you know, because and just you know, I mean, I guess they could draw it out, some people can draw well, I can't draw well, but, some people can draw well and some have a hang up about it but you know I liked, I liked how you taught that, how to just do

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simple little graphics and not worry about detail and things like that, and to just

practice on making your people and you know basic things that you're going to

use and there a lot, because I think they could definitely be sketched out with

some practice. You know, I think sketching them out rough hand the first time

might not look so well, might not be able to be readable, but you could definitely

practice and go from that. But that's what I see as one of the biggest hang-ups is

just designing it, you know, and then, some people, I don't think instructors so

much, I would hope that most of them would not have a problem being able to go

through the information and pick out what message they're trying to give to their

students, you know, I think for the most part they should be able to, to know

exactly what it is they're trying to teach their students.

She comments on the use of labels to help offset challenges students might have

with the drawing aspects of infographics stating, "If you put the label with it, then, then

people automatically know what you meant and they're not hung up on the drawing."

Becky also described experiences in her classes where drawing challenges had been

addressed. She explained the experience,

Yeah, at first they're, I get several comments, you know, I can't draw, you know,

I don't know how I'm going to get through this class, and you know, and, and

even after I've told them you you know, you don't have to draw, you don't have

to be able to draw, you just have to be able to put your idea down on the paper

and but once, and one of the hardest ones is the very first lesson, so, I guess once

we get that one out of the way and they see that I'm not grading on the drawing,

then they are okay from there, you know, and I actually see that they improve as

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time goes by. I can see a big difference from the very first lesson to the last lesson cause they're able to express themselves a lot better because they are not hung up on that drawing thing.

She adds another way to help students overcome the visualization challenges.

Yeah because, because you're getting into the visual you know, and that's, but yeah, I don't think you should put a lot of time in this because, and maybe you should tell them, you know, don't get hung up on this part, this is just there for the extras.

Drawing versus technology. I asked Becky her thoughts about utilizing a sketch-based approach compared to using technology tools to develop infographics. Becky thought that sketching would be a good approach for students but added that teachers using infographics might be more concerned with the appearance of the infographic. She commented,

I think it goes back to the content's more important so, if it's sketched I think that's fine. I think if you're using it as, if you're a teacher and you're using it as a model, then I think it might need to be, you know, have detail and color and you know, be more beautiful, but, if, if you are actually using it as an assessment I think it shouldn't. I think you should be basically just sketched out, and because you don't need to be dwelling on what colors you're going to use or you know, how, you know, is this balanced, and is this symmetrical and all that, I think, it just, in some ways you've got to think about your layout because it's got to be something that's going to be easy to view, easy on, easy on the viewer's eyes,

you've got to be able to still pull them in you know, make them want to look at it but still more so the content of it, it's how much do you know.

Participant Viewpoint - Diane

Diane has been teaching in post-secondary education for six (6) years. She is an Associate Professor of the Natural Sciences primarily teaching Biology along with Anatomy and Physiology. Diane holds a PhD in her discipline and has experience as a post-doctoral research scientist. Diane does not use infographics as introduced in the study but she indicated that she likes to use information visualizations when possible. She describes a tendency to use visualizations for her own learning and when teaching others. Of all the participants, Diane appears to apply the concept of visualization to learning more so than some of the other participants. She also seems to be the most connected with this type of learning as evident from some of the comments she shared during the interview. Diane shared,

I like representing, I, I, I like artistic outlets and it's fun for me to draw things. When I lecture, I, I try to use lots of graphs and images and I create my own or modify the ones that come with their books and things so I create a lot of simpler ones and I just, I enjoy that so, visually representing things is in, is intuitive and, and fun for me.

Although Diane uses visualization techniques in her classroom she thinks that infographics might be a more efficient way of using visualization for learning, "I wouldn't, not have used that word, but after being exposed to the idea, I do use it, I don't think I use it as efficiently as I could now that I, I'm understanding, learning from this experience."

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Diane developed an infographic to describe the concept of homeostasis to her students. Homeostasis is an overall concept that she utilizes throughout the course. Figure 21 displays Diane's sketched infographic.
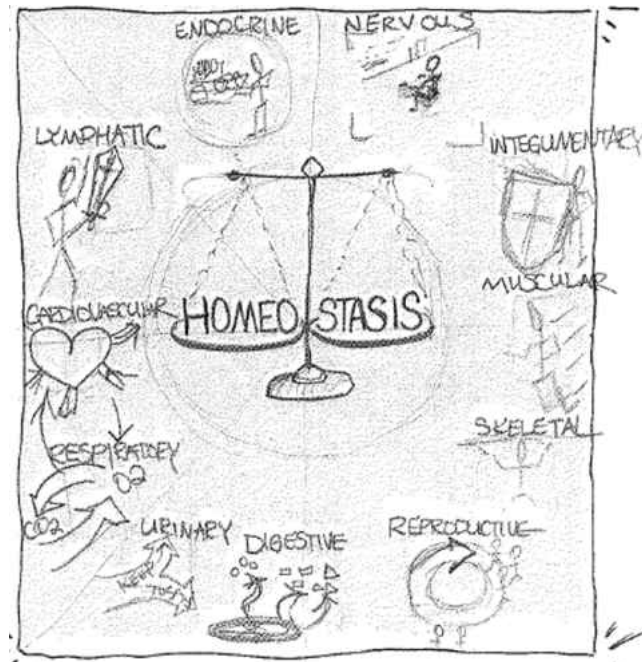
Figure 21. Diane's infographic

Diane uses the following narrative to describe her infographic. "The human body is a complex system with many individual parts constantly working hard to maintain balance and keep the system up and running. This constant internal balance despite outside conditions is homeostasis."

In this section, we will explore Diane's experience with infographic development. The graphics in Figures 22 and 23 illustrate how Diane perceived her infographic development experience. This diagram was constructed based upon the frequency that she mentioned concepts and topics related to the five underlying themes surfacing from the study.
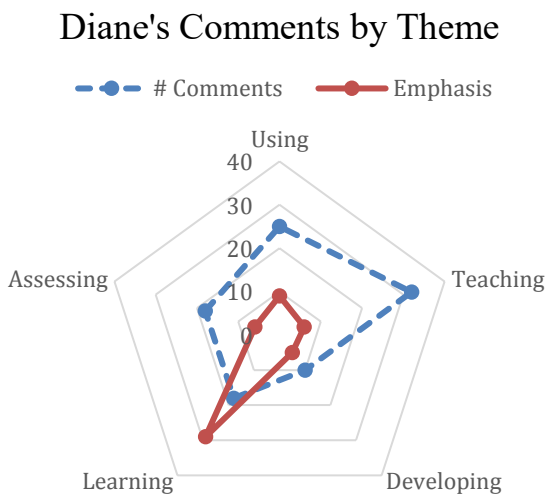
Figure 22. Diane's comments and emphasis by theme – radar chart. The dotted line in the figure represent comments made by Diane related to the themes of this study. The solid line represents areas that Diane emphasized.
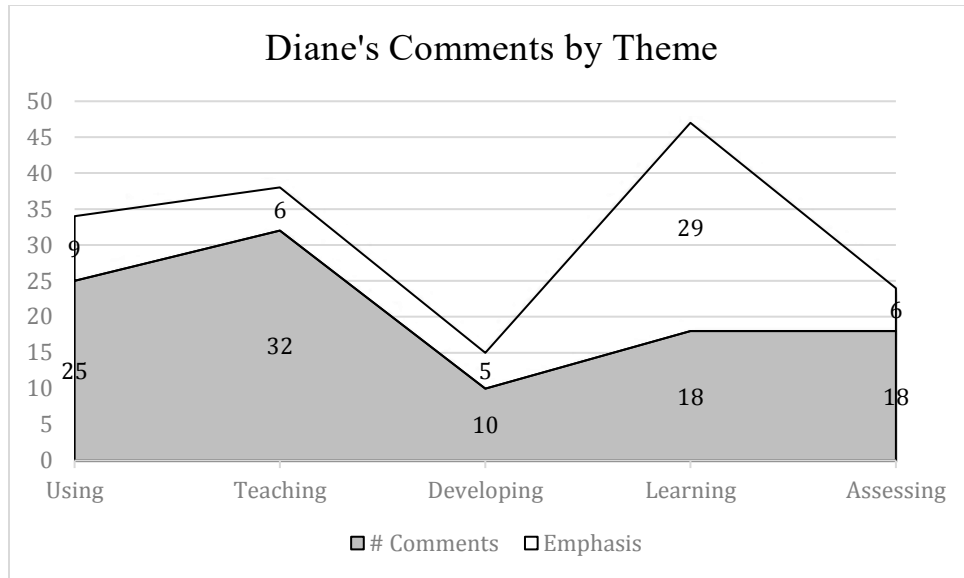
Figure 23. Diane's comments and emphasis by theme – area chart. The area at the bottom of the graph displays comments made by Diane related to each of the study themes. The area at the top of the figure provides additional comments made by Diane emphasizing comments and themes.

Table 21 provides an overview of Diane's comments by theme. Diane's experience classification based on the theme analysis is L-T-U-A-D.

Table 21

Diane's Comments and Emphasis by Theme

	Theme	# Comments	Emphasis	Total
L	Infographics and Learning	18	29	47
T	Teaching Infographics	32	6	38
U	Using Infographics	25	9	34
A	Assessing with Infographics	18	6	24
D	Developing Infographics	10	5	15

Diane's experience with infographic development influenced her thoughts more about the learning influences (L) associated with infographics and the development of infographics (D). The theme of assessment (A) received more attention than that given to teaching infographics (T) to students and the factors influencing the usage of

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infographics (U) in post-secondary education. The following section provides perceptions and thoughts that Diane shared with me about these themes.

Infographics and learning – Diane. Diane discussed how she thought infographics influenced learning. Among the concepts she mentioned were infographics value as a learning tool; how infographics influence the creation of a visual story to improve understanding, retention, and recall; how infographics promotes the development of connections in content that might otherwise be missed; and how the process of developing an infographic fosters critical thinking about the content being learned. Table 22 provides an overview of Diane's thoughts about the learning associated with infographics.

Table 22

Learning Associated with Infographics - Diane

Infographics and Learning - **Diane**

Emphasized Concepts
- Promotes critical thought, higher-level thinking, critical analysis
- Promotes visualization skills; visually communicate understanding
- Find connections in content; conceptualize a topic, identify patterns
- Valuable for students to go through process; finding a way to learn
- Something different, another form of learning, open our minds to new ways of learning, way to challenge students
- Efficiency of learning

Other Concepts
- Promotes in-depth understanding; perspective
- Reinforces learning; retention and recall; memory/study aid
- Meets needs of different learning styles; learner needs; might not be for everybody

Other Concepts (continued)
- Helpful to teachers – informs instruction; sensitive to learner needs
- Promotes big-picture thinking
- Stimulates engagement; encourages attention; students connect with this more
- Stimulates social environment conducive for learning
- Lots of information in a small area/condensing/organizing
- More meaningful learning
- Opportunity for discovery; see the story develop; see learning represented; provides way to visualize learning
- Great way to learn, helpful
- Fosters creativity and imagination
- Encourages thought, deeper thought; rethinking

Infographics value as a learning tool. Diane has used visualizations before to help her learn concepts and during the process of creating an infographic and she discovered that the process would also be good for students to go through. She said, "I think it's, it's helpful for students to get a chance to put those ideas into a picture …" and added,

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I create images all the time like in PowerPoint. And it's a really good learning

tool for me but I, and maybe I'm getting too far ahead, I didn't think about how

valuable it would be or how efficient it would be for my students to do that.

 I think previously I thought like it was my responsibility to create graphics that

were a good representation of what I was trying to teach but I feel now that that's

still valuable but it's valuable for me to have my students go through that process.

I didn't appreciate that before.

Visual storytelling and finding connections in content. Diane mentioned several

times about how she thought the process of developing an infographic was similar to

creating a visual story. She indicated that in the creation of this visual story, student

would become involved with the content more and is in this creation of a story, she

thought, that students were able to hold on and retain information and aid in recall.

I think we talked about creating a, getting a snapshot of the student's big picture

view of the concepts, you know, are they making the right connections, are they

seeing the big picture? I think that's a really positive, it lets them go through a

process and build up their understanding and they're much more likely to

remember it and carry it with them in a meaningful way. It's kind of like

storytelling… I think this is a similar kind of thing, it's creating a visual, a story

visually.

Diane also described how she used visualizations to help her learn new

content as a student. She elaborates on how students sometime might struggle to

make connections with content that provided by instructors.

You know, it's so funny, PowerPoint enabled us to show these beautiful, complicated pictures and it seemed like such a great idea because we put it up there but students seem to have so many more of those light bulb moments when you start with a circle on the board and say here's a cell, because they see the story develop piece by piece and you know, I have been there as a student and as an educator, struggle, you know, as a student struggling to make sense of all these pictures because when you're teaching it looks like it all makes sense. And then when you get a set of lecture notes, oh that looks, that makes sense, but that's a wholly, a whole different experience than making it your own, you know. In grad school I was really struggling at first because we had all these team taught classes, big sets of PowerPoints and I would read them and think okay, okay, that makes sense and then get a terrible grade on the exam and realize what happened, this never happened in college. And then I realized, I've just got to draw everything, I've got to make my own set of notes, I've got to make this my own, so, I think infographics would be a great way of doing that.

Fostering critical thought. She added that she thought that it was in the creation of the story that students might be able to make connections across the content that might not otherwise be made and to critically think about the content being learned.

I think about phrases like critical thinking but, but what I, I don't know (laughs), I think what it, what's the word I'm trying to use, it causes students to see connections and to integrate seemingly unrelated topics. It's like writing a story, instead of memorizing a list of facts, so I think an infographic, in the sciences is

particularly valuable because they get to create a picture or tell a story about things that seemed [emphasis] unrelated previously."

Diane added, "I think it would cause them to revisit a greater array of information and put it together in one unified unit, as opposed to seeing them as a bunch of disjointed things they have to memorize. That's what I think would be really useful in a science course like what I teach. I have study guides with all these questions that I think cause them to build the story, but I find that a lot of times they don't do that, they just want to make sure they can answer each question, and they don't even see that I'm trying to put things together by this series of questions, but I think if they had to make an image there would be no choice but to see some connections.

Diane talked about how going through the process of developing an infographic would require students to go beyond memorizing content.

I think that's critical thinking. I mean the thing that's really hard for my students in anatomy and physiology, is there's a ton of memorization of new language, but there's also, it's not just that either, it's really conceptual so you can't just rely on memorizing words and you can't just casually think through things you know.

Teaching infographics – Diane. Diane provided several suggestions on how infographics might be taught to students. A complete list is provided in Table 23.

Table 23

Teaching Infographics - Diane

Teaching Infographics - **Diane**	
Preparing to teach an infographics lesson (thoughts) • Additional infographics training • Being able to adapt to a new way of teaching; modify teaching approach • Willing to be creative • Learning something new may be overwhelming **Planning and preparation** • Don't move too quickly, spend some time • Be mindful of time give to assignment • Class time devoted to infographic training • Infographic assignment should follow an instructional activity; preliminary assignment; lecture • Introduce early in the semester • Being able to choose the right level of assignment complexity • Need right preparation **Instructional practices** • Provide examples/samples • Use groups • Use a process, model, approach • Start small, simple, slow	**Instructional practices (continued)** • Demonstrate, provide examples, work along with students • Allow for revisions, flexibility, freedom to create • Make it fun • Teacher uses infographics in class • Provide clear instructions • How it is introduced • Be mindful of student knowledge base **Learner support** • Provide tools, resources, cool stuff • Don't just introduce without support • Teacher participation, involvement, support • Provide visual layout and organizational assistance • Be patient and supportive • Inform students up front about materials needed **Training environment** • Individual white boards/dry-erase boards • Highlighters, markers, pens • Paper • Foster a creative atmosphere

Among these suggestions she talks about the value of going through the process of the infographic, changes necessary to class structure/teaching approach, allowing time for student creativity, providing flexibility and freedom into the assignment

A valuable process. Diane reflected on the infographic development process commenting that she had made a note to herself about the process, "I wrote the value of infographics as a teaching tool, that it's efficient, and it's a good process for my students to go through." She added that she thought that the process of developing an infographic would be good for students to experience.

I realized that does not work, lecturing them, and I mean, I should have known

that anyway I guess, lecturing over that doesn't work. So ever since then I've tried

some kind of graphic in class and some have been better than others, but I think I

just water it down and dumb it down too much, I give them such a, such a basic

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template that I created and have them fill in the blanks, maybe it would be better off for them to go through the process you know, give them time to go through the process of putting the picture together themselves.

Class structure. Diane thought that infographics would require potential alterations to the class structure and teaching approach utilized. She mentioned the need to move away from traditional lecture-based approaches to more student-focused or student-centered approaches.

Yeah, is it student-centered or lecture-focused and it would need at least part of a class would have to be a little more student-focused. Because again what sort of struck me is that I've been creating these images that I think are good teaching tools but the more powerful teaching tool [laughs] is to let the student create the picture.

She continued,

Well, the teaching skill, it would, the teaching approach would certainly need to be one that's not in the lecture-exclusive approach. It would not, I mean, by, by definition, if you're doing this at all, you're not just lecturing, right. So someone who is comfortable exploring that, I think we're all realizing it's important to do that and most people are doing it so as an educator it wouldn't, it wouldn't fit in with a strictly lecture approach. And you know, someone who is willing to create, to let their students work in groups, and people talk about covering everything [laughs] you know, in enough time, and I've been one of those people that's why I know that so well, but I think you get, you cover a lot more ground in a more

meaningful way when you take time to let students [pause] appreciate it a little more deeply.

Provide students with time for creativity. Diane shared that she thought students developing infographics would need room to be creative and that teachers would need to be patient and prepare students for the infographic development process. She said, "I think it's really good for students but I think we'll have to be patient and give them the right preparation for it." Diane elaborated,

> I learned that you need to create, that you need to give people time and allow for a little creativity if they're going to visually represent something, and I think some of the class projects that I have, and I kind of said this already, we're just a quick, make sure you've got this concept, show me that you understand this pattern instead of giving people the time to have multiple revisions you know, to build, to build their idea of something. And it was just fun, I mean, creating in an environment where there's lots of paper, lots of markers, you know, you feel like getting a little creative.

Diane reflected on skills that an instructor would need mentioning "patience and plenty of time [laughs] you know, not rushing through gobs of material, it takes practice choosing the right level of complexity and the degree of exposure to a subject. Is it something that's new or have they already seen it?"

Freedom, liberty to develop. Diane suggested that teachers be aware of the amount of liberty and freedom that students are given in order to develop their infographics. She adds,

We draw pictures together all the time but I think they should be doing it

[drawing] instead of me. But it's very helpful for me. And I have them draw

things, I mean, we draw hearts, and they draw in blood flow, and we draw, you

know, cells, and, and patterns of things that are happening in the body but not,

not, we don't try to get at a complete story, it's just, I think I make it too simple, I

don't think I give them enough liberty in the assignments that I do currently.

She continued,

We do lots of drawing or manipulating a figure that already exists in an

incomplete form, the differences again are just in the amount of liberty the student

has to be creative and to synthesize on their own. So I like the infographic better.

Using infographics – Diane. Diane thought that infographics could be used in

her discipline and in other post-secondary educational disciplines stating that

infographics are a "Better way to provide instruction." She commented further,

I mean it's just a much better way, my student's greatly appreciate the images and

videos instead of just me talking [laughs] and talking about some things. [One of

Diane's subjects] is a very visual discipline so I think it fits perfectly. In post-

secondary education, I think it's good, I'm not sure all of the ways it could be

applied but I certainly think in class as an activity to evaluate you know, to

evaluate progress during class and then I would like to see longer-term projects

too where they get to revise it.

Diane described how infogrpaphics could be used in other disciplines, "I don't

know that there's any discipline that it wouldn't be helpful to do that unless

you're just not a visual person [laughs] I don't know." Further, "I think certainly

it makes sense to create visual representations for complex ideas and every, I

mean, in just about every subject. I thought it was interesting"

Diane also mentioned several concepts that could warrant the use of infographics.

Table 24 provides an overview of Diane's insights into uses for infographics.

Table 24

Uses for Infographics - Diane

Infographic Uses - Diane
• Assessment
• Student notetaking
• Projects
• Alternative/optional assignment
• Flipped classroom assignment

She thought that infographic assignments can stimulate student engagement,

promote a social environment conducive for learning, and accommodate different

learning styles.

Stimulates engagement. Diane reflected on the infographic development process

and commented that the act of creating the infographic encourages and stimulates student

engagement.

I didn't even think about this, but one of the other reasons I started doing things

like this is because it forces them not to be so passive and the people who are just

like, checked out and expecting to receive instead of process you know, you see

that immediately, they realize [gasps] I'm being called on to interact with this

information instead of sit back and they think, I'll study it later at home but they

don't. I mean, if they, I think getting them to start interacting with it in class helps

them see what they're not getting. We didn't mention it earlier but just that

engagement, we hear that all the time, but it certainly forces, forces may not be a

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pretty word to use, but it stimulates engagement that wouldn't happen in a traditional lecture format at all.

She adds, "It gets them, you know, I avoid those words because they get used so often that they don't mean anything but engagement, it engages, causes students to be engaged with or engage with the material however you would say that."

Social environment for learning. The infographic training that the participants experienced utilized a group approach. At several times during the interview Diane commented on the how group structure and resulting social learning environment helped the overall learning process with infographics. Diane said, "It stimulates, in a face-to-face class, it stimulates the kind of social environment that you know, where students just thrive I think." She continued,

> I mean overall I thought it was excellent, I loved the format, I loved all the
>
> different that you had available to us, I liked the social interaction, I like there
>
> were people from other disciplines involved because it was interesting to me,
>
> even though I think if you're really trying to implement it, it's helpful to have
>
> people in a discipline, it's fun to see a new teaching tool in the context of other,
>
> other disciplines too. So it might be good to have, for, for teachers, it might be
>
> good to have training where it's not completely exclusive to a discipline, maybe
>
> there a few people in that discipline but there's some others mixed in cause that's
>
> kind of a fun part of the experience.

Visual learners. Diane commented that she thought an infographic assignment might be appealing for visual learners stating, "I think using that approach [infographic] appeals to really visual learners that we have today, people who have grown up with

more visual-based learning experience…" She elaborated further about this tendency towards infographics and visual learning activities cautioning that it may not be as easy for everyone.

> People who have that natural tendency are going to enjoy (emphasis) this more and maybe get more out of it, but that's you know, the trick in a classroom where you have a mixed group of learners. It won't be great for everybody but it will be wonderful for some people you know, people who have a natural affinity for drawing, sketching, representing things visually. I don't think it takes a really unique skill set, I could expect, I would expect everyone in a class to cooperate. I mean if there were, yeah, it just popped into my head though, if you had someone with a certain kind of, disability that would limit them you know, if you had a blind student in your class, you would have to make sure you make accommodations for that students. And I'm not sure how you would, I haven't encountered that would be important to think about.

> Diane suggested that infographic assignments might align with the learning approaches used by students stating, "Yes, I think using that approach appeals to really visual learners that we have today, people who have grown up with more visual-based learning experience." Diane also thought that there might be some resistance from students and teachers due to the nature of the infographics assignment and the associated grading challenges.

> That's the hard thing in any new, new idea or new approach, people or, some people are going to like it and some people aren't going to like it for any number of reasons, some maybe because it's new and different, but I think most educators

like doing things that are helpful to their students. I don't know anybody who doesn't like that. Influencing the use of infographics, if it's, not extraordinarily difficult and it's not something that's, you know, if it's not something that's painful for the students, they have a lot of pushback, but I don't think infographics would be, we're all seeing all these things about, don't be the sage on the stage, flipped classrooms, I think this is a really practical way of doing that.

She added,

I don't think any two people teach the same thing exactly the same way. I think rubrics and dealing with the pushback students are going to have to doing something that's unfamiliar and maybe uncomfortable for them [teachers].

Diane mentioned several classroom applications for infographics. Stating, "I can see lots of applications for in a lot of ways and I can, I can, I can put it into practice right away." Among these applications are flipped classroom assignments, and using infographics as "a note taking skill or a note taking approach."

You could do this everyday, I mean, I don't know if you would do it everyday because you want to change it up so it's interesting, but you could do it regularly with every big, new topic. And it would be an easy flipped classroom assignment.

Diane shared with me how she used to draw out her notes to help her learn new material. During our interview, we discussed how students could use infographic to help with note taking.

I tell my students all the time when they're struggling. I say here's what I had to do with lecture notes, this is from graduate school, and I said, I couldn't understand them unless I drew them myself and so I say, look when we talked

about kidneys I had to draw those things before it made sense to me I couldn't just look at those perfect notes. I had to make sure I noticed them myself.

Factors influencing infographics use - Diane. Table 25 provides an overview of the concepts that Diane perceived as being factors that influence the use of infographics in post-secondary education. Of these factors she emphasizes requiring a different approach to teaching, teaching abilities, student familiarity with infographics, potential student resistance associated with using infographics, learning style considerations.

Table 25

Factors Influencing Infographic Use - Diane

Factors influencing use of infographics in post-secondary education - **Diane**	
Teacher influences	**Student influences**
• Requires different teaching approach	• Student population, generational, cultural consideration
• Teacher not open to trying something new	• Learning style/Learner type considerations – visual learners
• Resistance to changing method of teaching; status quo	• Students not familiar with infographics – pushback
• Instructor understanding content enough to develop infographic	• Visual impairments; accommodations necessary
Curriculum influences	• Changing classroom culture
• Costs associated with infographic development materials	**Skill influences**
Time influences	• Drawing skill set/abilities
	• Visualization skills and abilities
• Takes time to learn (learning curve); extra work/time	• Design, layout, organization skills and abilities

Teacher influences. Diane mentions that using infographics would require a teaching approach different from that utilized in a lecture-based class. She said,

Well, the teaching skill, it would, the teaching approach would certainly need to be one that's not in the lecture-exclusive approach. It would not, I mean, by, by definition, if you're doing this at all, you're not just lecturing, right. So someone who is comfortable exploring that, I think we're all realizing it's important to do that and most people are doing it so, as an educator it wouldn't fit in with a strictly lecture approach.

Diane also suggested that instructional environments are changing to embrace different approaches. She said, "I realized that does not work, lecturing them, and I mean, I should have known that anyway I guess, lecturing over that doesn't work." She added, "We're all seeing all these things about, don't be the sage on the stage, flipped classrooms, I think this [using infographics] is a really practical way of doing that." She mentions how infographic assignments influence student engagement stating "…It [infographic assignment] stimulates engagement that wouldn't happen in a traditional lecture format at all."

Diane described how teachers might need to alter their teaching approach moving away from covering content and focusing on impactful instruction. She mentions that teachers using infographics would need "…patience and plenty of time [laughs] you know, not rushing through gobs of material; it takes practice choosing the right level of complexity and the degree of exposure to a subject." She added,

> People talk about covering everything [laughs] you know, in enough time, and I've been one of those people that's why I know that so well, but I think you get, you cover a lot more ground in a more meaningful way when you take time to let students [pause] appreciate it a little more deeply.

Diane also reflected that the infographics assignment would not be embraced by everyone but added that overall, she thought that teachers were interested in practices that benefited students. She said,

> That's the hard thing in any new, new idea or new approach, people or, some people are going to like it and some people aren't going to like it for any number of reasons, some maybe because it's new and different, but I think most educators

like doing things that are helpful to their students. I don't know anybody who doesn't like that.

Skill-related influences. Diane described several issues that might influence use of infographics in post-secondary education. Among these, she mentions difficulties visualizing information, issues with the time associated with an infographics assignment, skills associated with developing infographics and learning style influences. Diane describe some difficulties she experienced and shared some teaching suggestions,

It was hard for me to take that big idea and represent it in a really concise way so it made me think about the time factor and just, just the difficulty turning an idea into a picture. You get initial images that pop into your head but then it needs a lot of revision and just waffling about different ways to represent it. I think my students will probably do the same things and will need the space to understand it doesn't have to be perfect right away and it's really never going to be perfect and you, and you told us that in the training session too.

Diane mentions that teachers may also struggle with skills associated with developing infographics. She provides suggestions for teachers that might be hesitant to utilize infographics based on artistic skill.

And some people, I don't know, I mean, some teachers may not be as artistically inclined and it might not come as naturally for them too. But in that situation, the emphasis would just be maybe simpler infographics, or still you know, the basic rubric. Students may be encouraged by the fact that the teacher uses really simple ones too you know.

Student influences. Diane recognized that using infographics might appeal to certain types of learners. She said, "I think using that approach appeals to really visual learners that we have today, people who have grown up with more visual-based learning experience." She adds, "I don't know that there's any discipline that it wouldn't be helpful to do that [utilize infographics] unless you're just not a visual person." Diane continued,

> People who have that natural tendency are going to enjoy this more and maybe get more out of it, but that's you know, the trick in a classroom where you have a mixed group of learners. It won't be great for everybody but it will be wonderful for some people, you know, people who have a natural affinity for drawing, sketching, representing things visually. I don't think it takes a really unique skill set, I could expect, I would expect everyone in a class to cooperate.

Diane describes the potential for resistance from students. She mentions that this resistance might come from a lack of understanding about the subject, hesitance to participate in an activity like infographics, and/or a concern surrounding the skills necessary to develop infographics. She commented on potential resistance, "Dealing with the pushback students are going to have to doing something that's unfamiliar and maybe uncomfortable for them." Diane continued,

> So the pushback to, to not feeling like they know enough to represent it accurately their familiarity, and the pushback to being artistic at all. Which again, you've just got to tell them it doesn't matter if it's pretty it just needs to be correct. And you know, for some students there's a pushback to that engagement process in the classroom in general. I didn't come here [laughs] to create things, I don't think

that's true, I think people appreciate it and if, as long as you have a nice classroom environment, they can get involved. But some people are just uncomfortable with doing anything, probably just because they are a little insecure about the information."

Diane reflected on her own experience during the infographics training and suggested that students may also have difficulty developing an infographic unless they understand the content. She said, "Well and the other thing too, I mean this is something that I've been studying for years and years and it's really familiar to me. It would be pretty daunting for a student to try to create an image about something they don't really understand.

Diane adds that although there is potential for resistance from students surrounding the use of infographics, she did not think that it would negatively influence the use of infographics. She said, "…If it's, not extraordinarily difficult and it's not something that's, you know, if it's not something that's painful for the students, they have a lot of pushback, but I don't think infographics would be."

Assessing with infographics – Diane. Diane commented on several areas related to the theme of *Assessing with Infographics*. She described how she thought infographics could be used as an assessment, pointed out assessment efficiencies that could potentially be realized, shared how infographics might reduce plagiarism, discussed how infographics could inform teaching, and provided suggestions and concern about grading infographics. Table 26 provides an overview of Diane's thoughts about assessing with infographics.

Table 26

Assessing with Infographics - Diane

Assessing with Infographics - **Diane**	
Thoughts about assessing with infographics	**Suggestions for assessment criteria**
• Good way to evaluate learning/demonstrate understanding; better, more comprehensive • Quicker, more efficient form of assessment • More authentic assessment of learning; hard to fake/cheat; eliminates plagiarism • Assessment of teaching; inform teaching • See gaps right away • Fun, easy, effective • Use a rubric	• Grade content independent of artwork/graphics quality • Depth of understanding displayed, key concepts clearly communicated • Balance between creativity and instruction **Other assessment suggestions** • Lower expectations early on; less emphasis on grade
Factors influencing assessment	
• Grading challenges/considerations • How to grade fairly; subjectivity of grading • Concerns about rubric for grading • New way of assessing, unfamiliar to students	

Using infographics as an assessment. Diane thought that infographics would be a good way to assess students in her discipline and in other disciplines in post-secondary education. She stated, "I think it's an excellent form of assessment in our discipline and in post-secondary education in general." She commented further that using infographics as assessment is "better and more comprehensive than the, like the quick, classroom assessments that I do." She also suggested that an assignment that requires students to represent their learning provides a way to gauge how well the student understands the material.

> Sometimes we cover things that I, mean, I think are pretty complex and if nobody has questions you think they've got it, but that's not true if you tell them to represent it, then you realize sometimes they don't even know where to start.

Assessment efficiencies. Diane thought that infographic format could be graded quickly and that student learning could be evaluated more efficiently. She said "I think

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that's a quick, efficient way to evaluate a large amount of material." Diane added, "It's a great way to evaluate your student getting the big picture about something in an efficient way that's easy to grade…" She discussed a similar assignment that she currently uses in class,

That's one of the reasons I do those quick drawing assignments cause I can grade them really, really fast. So it would cut down on the, we all complain about that right, the grading workload, I think it would be nice to spin it on how efficient that can be.

She went on to compare the grading of an infographic to the grading of a written assignment.

I can, and I also just want to go back there, it's efficient, it's a lot more efficient than writing papers. In a classroom I can walk around the room and very quickly, if I give them, even just fifteen minutes, in that amount of time, I can see if they're putting the big picture together or not.

In addition to quickly being able to evaluate student understanding, Diane thought that instructors could benefit from seeing how students are interpreting the content and that this information might help to inform the teaching process.

Absolutely, they're going to see, you see the gaps right away, I mean, even in just simple sketches and you're going to have some insight into that big picture if they're formulating, if they're making the connections they need to be making, if they're doing more than just memorizing facts, which is really important, and I think it will probably be really helpful to us too, I think it may cause us to teach

things in a different way sometimes because the connections that we'll see from the student perspective.

Diane also thought that an infographics might help to mitigate the problem of plagiarism.

And plagiarism you're going to know [laughs] in half a second. It's totally eliminated. What's that tool in Blackboard, SafeAssign, no need for SafeAssign, I guess unless people pull it off the Internet, I think you could still figure it out.

Using rubrics to grade infographics. Diane suggested that instructors use a rubric for assessing infographics.

I think we like as educators, we like rubrics and we like to look for specific things and I think you would have to create some kind of rubric to say, okay, this infographic might look, there a million ways it can look and be accurate as long as I see that people understand bones and muscles work together for movement, they illustrate that somehow. So I think mine could be evaluated by, well do I even show all the organ systems, are there, are there at least, you know, four or five examples of how systems work together to keep us alive, you know, you could, there's some variation how that could work. But as long as the infographic includes some representation of the key points then I think, you've, you've succeeded. The student, whoever, the, the artist, student, has succeeded.

Along with rubrics, Diane suggested that the effectiveness of the rubric lies in the guidelines and instructions given to students about the assignment. She describes a need to balance guidelines, instruction, and creativity.

Well I think people are going to initially say so what kind of rubric, how are you going to know if it's good or not good? And again that all ties back in to how did you assign it [laughs], what guidelines did you give.

She continued, "Just as long, you have to give them, it's a tricky balance between making sure they're clear instructions and there's room for creativity." She added the importance about providing "That right balance between creativity and some instruction, some useful instruction."

Grading concerns. Diane discussed the subjectivity inherent in an infographic assignment and the potential for resistance due to the graphical nature of the infographic. She stated, "It [infographic] is subjective and so there's going to be variation…"

She talks about the importance of having a good way of evaluating the infographic assignment,

I think just the subjectivity of the grading. It'll be hard to feel like this is a good assignment if you don't have a good way of grading it. If you don't have a rubric that says I need to look for three things in this infographic, you're going to kill yourself thinking if you're being fair between students or, well maybe you know how it is, if you don't have a good set of instructions, the really outstanding papers sort of sets the tone and everything else doesn't look as good [laughs] or you think well maybe I need to go in the middle. So having good guidelines in the beginning I think is really important. And some people, I don't know, I mean, some teachers may not be as artistically inclined and it might not come as naturally for them too. But in that situation, the emphasis would just be maybe

simpler infographics, or still you know, the basic rubric. Students may be encouraged by the fact that the teacher uses really simple ones too you know.

She also mentions the potential resistance surrounding the graphical nature of the infographic and the challenges that might pose to students. She does provide suggestions on how that potential challenge could be mitigated.

I think one of the downsides is that people are going to have some pushback to the artistic aspect of it [pause] but at the same time, it's not as intimidating as writing a paper. I mean they can do it quickly and it's over. And I don't want to assign a huge point value to the ones that they do in class so it's not intimidating. But then I may give some that are worth a higher point value that they have more time to develop. Maybe to revise what they start in class."

Inform teaching. Diane referred to a tendency some teacher may have involving their familiarity with the subject they teach. She indicated that this familiarity may keep teachers from seeing student struggles with new content. She elaborates, "Before you know it, you've been teaching this so many times it's like the back of your hand it sounds familiar to you too but you forget how overwhelming that can be for students." She also thought that infographics might be used to inform teaching,

Yeah if there's a concept that your students always seem to struggle with, you may, by looking at an infographic assignment, you may see, well, no wonder, fifty percent of the class never saw that these two things were, they never represented any sort of relationship here, and that's sort of foundational. The longer you teach the harder it gets to see things with fresh eyes, you know…, I think for teachers, this could be really helpful.

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Content over graphics. I asked Diane what she thought about the potential for the quality of a graphic to influence the grading of an infographic. She responded that the information or content was more important than the quality of the graphics.

> You know, I like pretty, artistic representations of things, but as a teaching tool, as long as the information is there, that's fine with me… actually, I would rather see a stick heart with the right information than you know, than them laying a piece of paper over the heart in their book and drawing it to make it look perfect, you know what I mean?

Developing infographics – Diane. Throughout the interview Diane described concepts related to developing infographics. Table 27 provides an overview of Diane's thought about skills required to develop infographics.

Table 27

Developing Infographics - Diane

Developing infographics - Diane

Skills required
- Understanding of content
- Ability to visualize and graphically represent concepts
- Basic art skills/abilities
- Design, layout, and organization skills
- No unique skill set

Other considerations
- Drawing over technology tools
  - Reason – lessons the learning curve, simpler, more efficient
  - Reason – lack of access to technology
  - Reason – more instructional benefits from drawing

Of all the topics she mentioned related to this particular theme, Diane focused on three (3) key concepts. These include (1) the challenge of visualizing ideas, (2) the challenge to condense and refine information, and (3) the understanding and knowledge needed about a subject in order to develop an infographic.

Challenging to visualize ideas. Diane explained some of the challenges that she experienced during the infographic creation process. Among these challenges she mentioned that she thought it was challenging to take an idea and visualize that idea in a concise way. She thought that students would experience the same difficulties.

It was hard for me to take that big idea and represent it in a really concise way so it made me think about the time factor and just, just the difficulty turning an idea into a picture. You get initial images that pop into your head but then it needs a lot of revision and just waffling about different ways to represent it. I think my students will probably do the same things and will need the space to understand it doesn't have to be perfect right away and it's really never going to be perfect and you, and you told us that in the training session too.

Diane continued,

I think it would help a student… I mean, I think it is always helpful to think of ways to visually represent complicated ideas so, yeah, I think it was definitely helpful. It helped me appreciate the complexity of the idea. So you throw around a word like homeostasis to a student and think, okay, I assigned it, they are going to be responsible for it, they've got to know it, but that's a big idea, and if it's hard for me to draw it out, it's going to be hard to, I guess."

Refining and condensing information. Diane reflected that it was challenging to refine and condense information so that only the key points remain.

Boiling it down you know, taking a big idea and cutting out the parts that aren't really necessary. I make things too complicated sometimes but really get, focusing on the most important points.

Understanding and knowledge about the topic. Diane elaborated that part of the difficulty in creating the visualization might stem from the understanding students may or may not have about a particular subject.

> I mean this is something that I've been studying for years and years and it's really familiar to me. It would be pretty daunting for a student to try to create an image about something they don't really understand. I tried something like that, I mean, I didn't call it an infographic but people always get confused by all these parts of the cell you know, and so there's this great picture in the textbook that showed one thing that happens, how milk can be produced by a mammary gland. So, and I thought, oh this is great, it shows the cell like a little factory, this starts here, and this goes here and then I had the students [laugh] like sketch out a version of it and they were just, very uncomfortable because they didn't really understand the foundational concepts so there's probably some preliminary assignments or reading or some kind of exposure that they need to do before, the infographic probably shouldn't be the first thing, I think, you know, it needs to be something they've gotten a little bit of familiarity to it somehow, through maybe a lecture.

Diane commented that students sometimes simply recreate images from the textbook or from other sources. She wonders if this might be because of a lack of understanding about the concept. She offered that students might think, "I'm not an authority on this, how am I supposed to write about it authoritatively without plagiarizing? [laughs]. How am I supposed to create a picture instead of just drawing one from the textbook?" In her comment she describes a recurring concept that students might resist this type of assignment for a variety of other reasons but the idea of not

knowing or understanding enough about the content to develop an infographic might be

fundamental. Diane shared,

> So the pushback to, to not feeling like they know enough to represent it
>
> accurately, their familiarity, and the pushback to being artistic at all. Which again,
>
> you've just got to tell them it doesn't matter if it's pretty it just needs to be
>
> correct. And, and you know, for some students there's a pushback to that
>
> engagement process in the classroom in general. I didn't come here [laughs] to
>
> create things, I don't think that's true, I think people appreciate it and if, as long
>
> as you have a nice classroom environment, they can get involved. But some
>
> people are just uncomfortable with doing anything, probably just because they are
>
> a little insecure about the information.

Diane's commented that the process of developing infographics and the

challenges experienced learning how to create an infographic about a new topic might

help teachers realize the potential struggles of students. She said, "You may help us, you

may help all of us be more sensitive to what our students are going through."

Drawing versus technology. I asked Diane what she thought about the approach

we utilized in the training employing a sketch-based approach as opposed to a

technology-based approach. She thought that the sketch approach might be better and

provided her rationale,

> I think you could do both I think the sketch, I have done it both ways and I think
>
> the sketch is certainly helpful because even though this seems really efficient, you
>
> can make quick adjustments. When you start trying to make it look really pretty
>
> with a computer tool, that ends up getting really time consuming. So I think a

sketch is efficient for the student and it helps them go through revis, you know, as soon as they start, they're going to be revising their thinking quickly so the sketching gives them the chance for, it facilitates their ability to think through and make quick revisions as their, as the idea is developing and you can do that with a computer program as well but it may come a little more easily by sketching it first. And it can be more diverse, you know, there's some, you can't do everything or I certainly can't do everything with a computer that I can do with my pencil and there are some things I can do with a computer [laughs] that I can't do with my pencil. Just like you went through the process of having us think about the layout and, you know, I just think that's a really important planning process.

She continued describing the challenges that a student might experience developing infographics using technology applications.

Yeah, you know, I think we particularly because we often have a lot of non-traditional students, and times are changing constantly but what if you have a student who's unfamiliar with the content, a student who's unfamiliar with technology and suddenly they're given an assignment that causes them to really wrestle with a lot of new ideas and causes them to spend maybe, you know, two or three days wrestling with a computer program they've never used to try and represent these ideas that aren't familiar. So that would be really important, maybe in computer classes where people are already in that world, they would eat it up.

Participant Viewpoint - Frank

Frank has been a post-secondary educator for 13 years. He is a Professor teaching in the Humanities discipline. Frank has a Master's degree. Frank does not use information visualization in his classes currently but is familiar with the concept of an infographic. Frank had researched infographics in preparation for the infographics training session to familiarize himself with the concept.

During the infographic training, Frank developed an infographic to describe the parts of an argument. He envisioned the components of an argument using a tree metaphor. Frank developed an infographic based on the parts of an argument – logos, ethos, and pathos. As he explained to his training group and to me during the training process, he wanted to develop an infographic that would communicate the idea of this process so his students would better understand the concept. Figure 24 is the infographic Frank developed.
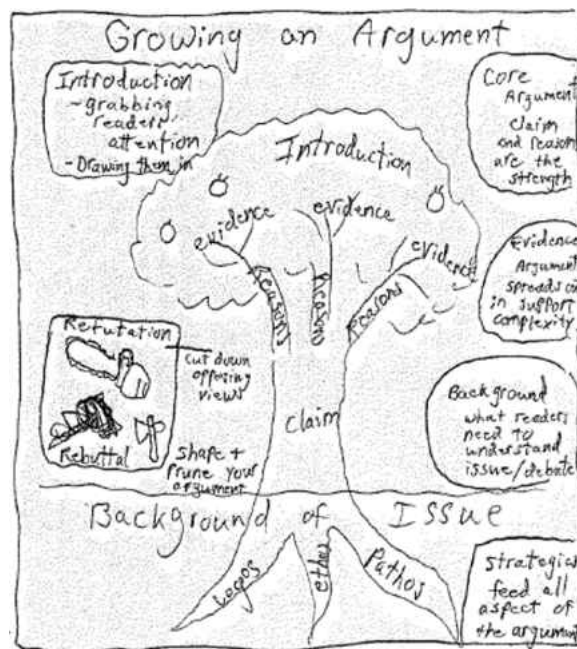
Figure 24 – Frank's infographic

Figures 25 and 26 provide a graphical overview of Frank's comments that he

shared regarding the infographics training experience. Table 28 provides an overview of

Frank's responses and comments relating to the five (5) themes of this study. I have

provided an illustration of Frank's responses to the interview questions.
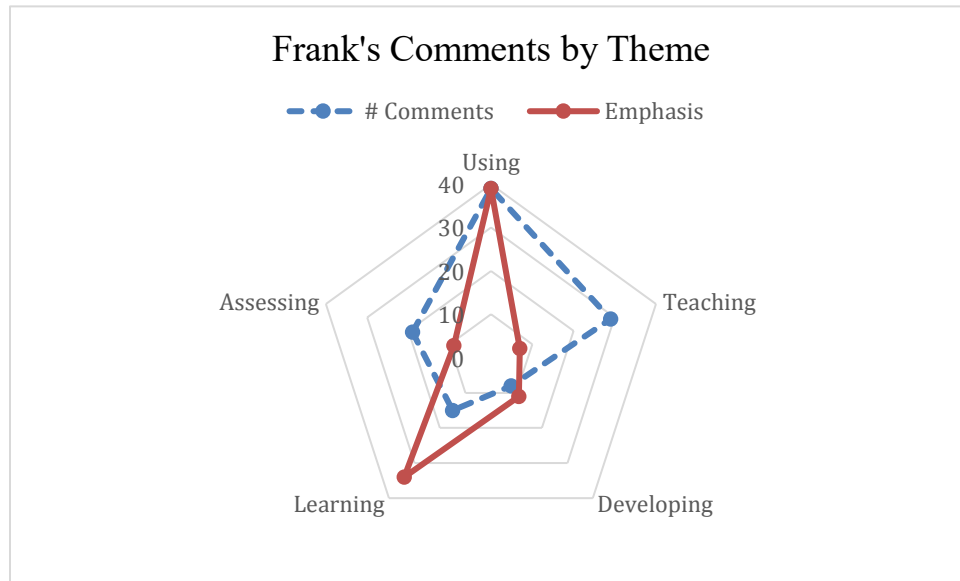
Figure 25. Frank's comments and emphasis by theme – radar chart. The dotted line in the
figure represent comments made by Frank related to the themes of this study. The solid
line represents areas that Frank emphasized.
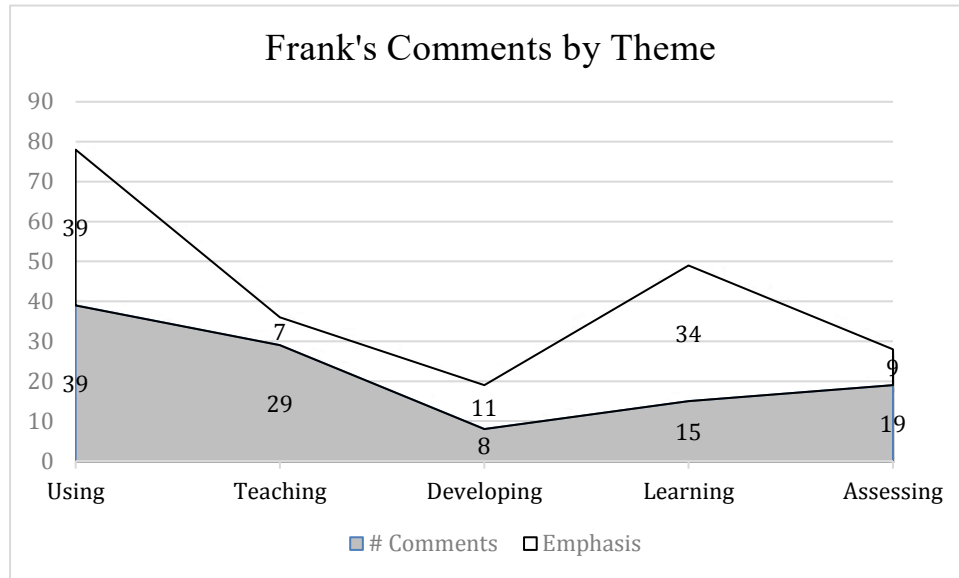
Figure 26. Frank's comments and emphasis by theme – area chart. The area at the bottom of the graph displays comments made by Frank related to each of the study themes. The area at the top of the figure provides additional comments made by Frank emphasizing comments and themes.

Frank's infographic training experience yielded more responses in the *Using Infographics* and the *Infographics and Learning* themes. *Teaching Infographics* and *Assessing with Infographics* received comparable numbers of responses followed by the theme *Developing Infographics*. Based on these responses I assigned Frank an experience classification of U-L-T-A-D to correspond to the number and type of comments he provided during the interview.

Table 28

Frank's Comments and Emphasis by Theme

	Theme	# Comments	# Emphasis	Total
U	Using Infographics	39	39	78
L	Infographics and Learning	15	34	49
T	Teaching Infographics	29	7	36
A	Assessing with Infographics	19	9	28
D	Developing Infographics	8	11	19

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Using infographics – Frank. Frank discussed several factors that he believed

would influence the use of infographics in post-secondary education. These factors

include the learning curve associated with infographics, the time-consuming nature of

infographics, teacher-related factors, and visualization/creativity factors. Table 29

provides an overview of the factors Frank perceived to influence the use of infographics

in post-secondary education.

Table 29

Factors Influencing Infographic Use - Frank

Factors influencing use of infographics in post-secondary education - **Frank**	
Teacher influences	**Time influences**
• Teacher not open to trying something new • Post-secondary slow to change • Resistance to changing method of teaching • Resistance from teachers • Extra work involved • Different than what currently doing; teaching style conflicts • Challenge teaching abilities • More difficult than traditional instruction • Instructor understanding of infographics • Teachers may not see benefit/value • Academic freedom	• Learning curve; extra work/time involved • Extra time needed; time challenges • Time away from other content; having to work in • Time and effort required; payoff worth investment **Student influences** • Student population, generational, cultural consideration • Learning style/Learner type considerations – visual learners • Potential resistance from students – initial resistance • Access to technology
Curriculum influences	**Skill influences**
• Curriculum/program restrictions/common courses/academic freedom • Differences by discipline/class type/assignment type • Difficulty determining best fit in a particular class; where to use	• Drawing skill set/abilities • Visualization skills and abilities • Design, layout, and organization skills/abilities

Learning curve. Frank shared "I can't think of any disadvantages other than I

guess you know, there would be a learning curve for it,..." he continued by discussing

why teachers might be resistant to infographics. "My only concern would be the learning

curve on how to, you know, get them up to speed on just doing this and then make sure

that there would be enough of a pay off for spending the time to teach them how to do

infographics,…" He added,

Because it's new and going to be difficult on the front end because you know, you do have to learn some things, learn the concepts, you've got to come at it in ways that are maybe different from what you're currently doing, and, and I think, you know, just to be blunt about it, I think some people think, well, my job's hard enough as it is, or I'm set in my ways, or I like what I'm doing, whatever, you know, spin they want to put on it, it's just, it's, you know, it might be seen as, you know, too much trouble, or, or if it ain't broke don't fix it, you know, whatever, you know, I'm sure there's a dozen clichés we can throw in there or excuses or whatever, but I think that's what it would come down to, so, good luck with it, I guess [laughs].

Time consuming/time commitment. Frank explained that he thought infographics could be time consuming

I mentioned obstacles or potential frustrations I guess for me was that, I think you know, in practicing, trying one, I saw that it could be very time-consuming and again that may be more about me than about the form itself, that I tend to overthink a lot of things so this will be no different than anything else I get involved in.

Frank continued addressing the time consuming nature of infographics suggesting that he would need additional training before being prepared to utilize the infographic in class.

Again my own worries about time that you know, cause it was, I worked on that for a while and it would need a whole lot more work, the infographic I did for the training, to where I would feel like it would be ready to use in a, in a classroom,

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even for just demonstrating, you know, having it up on the, the board or on a

PowerPoint or whatever, to walk them through it, so if I were going to use

infographics in a big way in my class that would be a lot of work on the front end

too, you know, to do these things, and then to teach students to do it, is a lot of

time and work in the class and then to be able to assess it, learn how to assess it,

cause there's got to be some trial and error with it I would imagine so this, it's a

big commitment for me, and so I think I'm sure most instructors would feel that

way too so I think in terms of, if the goal is to encourage instructors to do it, to try

it, then there's that, just that. You know is the payoff worth the investment and I

think you would have to come up with ways of demonstrating that.

Teacher-related factors. Frank suggests that teachers may be resistant to

infographics because the infographics assignment would require skills and abilities that

teachers may not currently possess and he questions if these skills can be acquired or

learned. He also implies that the infographic activity requires an approach to teaching that

takes students to higher levels of learning. He suggests that some teachers may struggle

with being able to engage learners at these higher levels of learning and implies that as a

result, teachers tend to utilize more traditional methods of instruction.

But I guess that would be, and so, if you're talking about, is that an ability that

they have to have initially or is that, that can be taught, I mean, that's the thing,

and I guess that could boil down to why some could resist it, is that, you know,

they might feel that they're trying to teach students to do something that could

even be separate from their discipline even, or their subject matter, because you

know if they get too hung up on the art they definitely would resist it in terms of

that you know, if they think, well, to get to that third level you have to have artistic ability which is not the case, but even that, you know, I have to say, and I've been there myself, I'll admit it as a young teacher, that I didn't have students go to that next level like I should have and maybe partly out of just fear of how do you get to that, cause you know, let's say a history class, something like that, it's a lot safer to just say, okay know these facts and dates and you know and give it back to me on the test but to actually have them take those, you know, history and make it about trends and processes and ideas and movements and now it's your getting into concepts and ask them to see you know, big picture stuff and that's a whole lot harder to do as a teacher and so, and I know when I started teaching you know, I knew the knowledge so it's like you know, so I could test them on that or I could quiz them on that or I could you know, take off a point for each comma or whatever cause you ought to know that rule but, you know, it has to go beyond rules and you have to be able to talk about strategies in writing, or talk about, and ideas, and how you can best communicate that idea, how you can move your readers to come over to a different way of thinking, and you know, that's, that's a whole lot harder and it did take me a while as a teacher to understand the need for that one, I didn't even know that's what I needed to be doing for a while, but then getting there is a lot more work, anyway, I'm kind of going back to earlier questions about you know obstacles that you might have as getting somebody to, to, to, get people to try this, is that you know, you may have to be, I mean, I guess it goes back to the idea of being set in our ways but why are they set in their ways, that may be one reason is because it is so much harder to move students to the

conceptualization stage, but this might be a way of doing that, that the, that they

can, the instructor can relate to and students can relate to and maybe this will be,

actually alleviate some of that, that fear. Getting them to admit that they have that

though, that's a whole other thing.

Infographic uses in post-secondary education. Frank had several comments

relating to using infographics in a post-secondary context. Table 30 provides an overview

of the infographic uses Frank mentioned.

Table 30

Uses for Infographics - Frank

Infographic Uses - Frank
• Assessment
• Presenting/communicating ideas
• Storyboarding
• Alternative/optional assignment

Frank focused on the use of infographics as a way to communicate and present

content to students, as a course planning and organization tool to help teachers plan their

courses, and as an alternative to an existing assignment.

Communicating and presenting information. Frank shared that he thought

teachers could utilize infographics to communicate and present course content to

students. He said, "I could see where it would be useful as a way of communicating ideas

to them." Frank also thought that using infographics as a means of presenting content

would improve his course delivery stating, "Certainly in, like communicating ideas,

lecturing, I mean it could bring, definitely bring fresh ideas and approaches to my

lectures…" Frank continues to explain how using infographics to present and

communicate course information could be beneficial for students.

I think when tied to the content of the course, particularly if you're using it to present information, if you have your own infographics as part of PowerPoints or handouts or whatever, and so they become part of their, the way they, they are introduced to the material and access the material and to assess their learning of the material using that same approach would not be difficult at all, I mean, it would sort of be natural, and you know, assumed that you know, they could do it that way. So yeah, I don't see any major disadvantages and a lot of potential positives.

Frank also suggested that student comprehension of course content may be positively impacted by teacher use of infographics in the presentation of course material. if teachers used infographics-based presentations.

And again for instructors in their planning and their presentation, and in students in gaining you know, deeper insight for the presentations, because you know, you can read a chapter in a book, that's one thing, but to see the key information up there and again how things all tie in, that's a plus obviously, additional benefit.

Frank suggested that teachers could use infographics to help students understand the concepts of a course by providing a visual overview connecting the concepts of the course.

I think any good class should, students ought to be able to pick up on connections but if you're just like, we're going to cover this, and then we're going to cover this and there doesn't seem to be any connection with each thing, I, I, I don't think that's a very good class, if that's the approach you have, I think there has to

be a, you know, where students see how it's all connected in one way or another, and this [infographic], you know, you've got it all right there visually.

Course planning, organization, course design. Frank described how infographics could be utilized by teachers in the planning and organization of a course. He suggests that the infographic provides the teachers with a way to look at the course holistically and in doing so, improves the planning, organization and design of the course. He shared that the process of developing an infographic helped him to evaluate his course and "reconsider and reevaluate what I do and how I'm doing it,…" Frank continued,

I think this sort of thing helps to, to tap into that sort of thinking, that, conceptual… there's a word for it, you may be able to help me with it, it's almost like thinking, you know, in 3D form, about a course rather than a course schedule, and you know thinking very two-dimensionally about it, so it was helping me to think three-dimensionally about online learning, and of course I realized you could probably apply that to any, anything, any, any course you teach, any discipline, any whatever, particular class, that you want to be able to think about it from different angles, and to, to, and to think about it in 3D form, I think you can, and I think what I mean be that in terms of any course to see how everything connects, everything flows, everything builds, how concepts you know, work back on themselves, you know, that idea or you know and so I think infographics would be a great way to plan for that but also to communicate that to the students what we're trying to do here.

Frank explains that teachers might find value in using infographics if only used in course planning. In his explanation he shares benefits of this approach to course planning.

If nothing else, they would benefit from using it in the planning of their courses, particularly online, since it's so hard to bring that 3D thinking too, but with any class, I think it would, you know, because its all about, I think any good class should, students ought to be able to pick up on connections but if you're just like, we're going to cover this, and then we're going to cover this and there doesn't seem to be any connection with each thing, I don't think that's a very good class, if that's the approach you have, I think there has to be a, you know, where students see how it's all connected in one way or another, and this, you know, you've got it all right there visually.

Frank continued to reflect on the positive impacts infographics could have on course planning.

I realized you could probably apply that to any, anything, any, any course you teach, any discipline, any whatever particular class, that you want to be able to think about it from different angles, and to think about it in 3D form, I think you can, and I think what I mean be that in terms of any course to see how everything connects, everything flows, everything builds, how concepts you know, work back on themselves, you know, that idea or you know, and so I think infographics would be a great way to plan for that but also to communicate that to the students what we're trying to do here.

Frank shared his thoughts about how he might use infographics to plan out his own course(s), stating, "Where infographics might be a value is to help instructors to plan out their course and understand, okay, what are the most important concepts and what do I want to get across."

As an alternative assignment. Frank discussed how an infographic assignment might replace a current assignment and reflects on how an infographic might provide a better way to approach the assignment.

> I definitely see a lot of possibilities to replace some current assignments that, one I've mentioned already, the rhetorical analysis I think the idea of bringing analysis to rhetoric, to have plans going in to be writing about an audience, to be thinking about your audience and what you know, all these sorts of things I think is the number one goal I have for a composition class beyond even the words on the page I think it's so much about the critical thinking that cause if you're doing all those things then the words on the page are going to be better and there's going to be more depth, and better organization, and, and sort of you know, they go hand in hand so that's, that's, I'm big on that in my writing class but the rhetorical analysis assignment would be, cause that's something early on that I do to get that concept across that there's so much going on in a piece of writing before there's anything on the page, in the process, during the revising stage, if you're bringing this critical thinking to it, you know, it's going to be better and more valuable, and this may be a way of getting at that concept better than what I'm doing now. And not just replacing it for the, I mean just to do it for the sake of variety would be, would be worth it for me, but I think this might be a better way of coming at those concepts, so that's pretty exciting for me.

Frank described how an infographic assignment could be used in his courses which rely heavily on written as opposed to visual components. He suggests that infographic might provide a viable alternative to existing teaching approaches.

Yeah, I think with the writing class I firmly believe the old saw about the only

way you can get better writing is to write, so, it, it, couldn't replace that activity

but then again, you know, that doesn't mean we have to write all day, every day,

and every assignment, and that's not the only way that things can be assessed,

even in a writing class, so I can see it replacing some things…

"I could see the potential for doing, for, for getting at the same sorts of concepts,

and getting the, meeting the goals of the assignment do it in this form rather than

writing in that case so, it should be a good thing for me and for students to have

some variety and that way in a writing class.

Infographics and learning – Frank. Frank's comments during the interview

process are rooted in his description of how the infographic development process

influenced his understanding of the subject he selected for his infographic. He describes

the learning that he experienced. Frank was initially skeptical about how the infographic

might be used within his discipline. Frank described his experience developing the

infographic more in terms of how it helped him to understand his topic better and at a

deeper level. He refers to his experience as helping him to think about thing differently,

looking at things at different angles, and to see connections within the content that he did

not see previously.

Mine of course [referring to infographics topic] was the classical argument

structure really essay structure kind of expanded a little bit. And yeah it helped

me to think about it in terms of, the different sections of it and how each of them

have their own unique, or relatively unique, I guess functions, but yet they're all

interconnected and then they're all informed by the same strategies, and so I talk

about each of those elements separately anyway, but the infographic I think helps

to tie it together, and it was tying it together for me, the idea that you know, like

logos, ethos, and pathos, in particular, that those concepts do, can inform and feed

all aspects of an argument and all aspects of the essay from introduction all the

way through to conclusion. And I know that, and I, I'm sure I say that in some

way in class, but it's, you know, knowing it and, and briefly saying it is not the

same as really seeing it and understanding it, so I was kind of, actually seeing it in

a fresh way, in maybe even a deeper way, and that's kind of almost embarrassing

to admit that I didn't get the full impact of, you know, I know the importance of

it, but I didn't, I can understand it and see it in a deeper way now, and it all helped

with that, you know, I felt you know, I hated to use the tree one cause that's so

used all the time, I thought, I could do, be more creative than that, but, but it was

really good in that it, it really brought the idea of, and I had logos, ethos, and

pathos as the roots feeding all the other parts of the argument and that metaphor,

that concept just really gave me a better understanding of it, a deeper

understanding, so of course it would with the students too, I think. Anyway, so

that was, that was actual you know, discovery, about my own topic as a result of

the infographic so, I mean, that's awesome, and so obviously shows the potential

for, for me and this concept in particular,

Frank expanded on this opportunity for discovery and reinforcement of

learning from the student's perspective.

If they're [students] actually producing infographics on their own, then they can

have that, you know, potential discovery, and, and sort of see, again to go back to

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that term that I used kind of half-jokingly before, but meta, you know, being able

to see their own learning represented, you know, so you can kind of see that, it's

helping them learn but then they can see what they've learned in the process all

on the page, it's a, I mean, it's like reinforcement to me, you know, deepening.

Frank continued to reflect on how the infographic development experience

influenced him.

Actually what I'm saying though, I think I just actually talked myself into seeing

it as valuable, and not that I didn't see it as valuable, more, but valuable even in

composition, worth the time to show the students how to do it, because if they can

have the same experience with some, any concept somewhere along the way that I

was having with a concept that I've taught literally three hundred times maybe a

lot more than that but I'm seeing it in a new, fresh way, well, you know I'd like

for students to have that same experience so it would be worth it to, you know, to

bring it in to make that happen, try and make that happen for them, so.

Frank also commented on several aspects of learning that he believed were

attributed to infographics. Table 31 provides an overview of Frank's perceptions and

insights into the learning impact associated with infographics.

Table 31

Infographics and Learning - Frank

Infographics and Learning - **Frank**	
Emphasized Concepts	**Other Concepts**
• Promotes in-depth understanding; perspective; understand better, more deeply • Something different, another form of learning, open our minds to new ways of learning, way to challenge students • Find connections in content; conceptualize a topic, identify patterns • Opportunity for discovery; see learning represented; provides way to visualize learning; metalearning • Infographics as a teaching activity (students – teach to learn) • Encourages thought, deeper thought, rethinking; reinvigorates, stimulates, mind, exciting • Promotes big-picture thinking • Impacts learning • Value of condensing information	• Promotes critical thought, higher-level thinking, critical analysis • Reinforces learning; retention and recall; memory/study aid • Promotes visualization skills; visually communicate understanding • Fosters creativity, imagination • Meets needs of different learning styles; learner needs; might not be for everybody • Fun factor

Interconnections and visualized learning. Frank reflected on his experience developing infographics and suggests that one of the primary learning benefits of the infographic development process is that it facilitates the identification of connections within the content being learned to produce what he refers to as 'a visual representation of learning'.

> Yeah, well I think, I think that's what I was finally kind of was, coalescing there at the end of last answer was just that, it's that idea of being able to see things from a fresh perspective, see connections flow, you know, depending on the subject, I think that seems to be a key part of most infographics that I've seen, is to visually represent connections and, and flow particularly if there's a sequence involved, or a, a process involved, it's a, to a, I have a visual representation of that process, but it a, but even if there's not a linear or a step-by-step or stage-by-stage flow to it, just to see how ideas connect to one another in some way is, it's a, at

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least for me at this point, you've done a lot more research than I have, but that seems to be the biggest benefit that I'm seeing so far, is that students can see interconnectedness of ideas, and, and flow of ideas even, or concepts and how they can build on one another, and so if students can, I mean, for me, that really just taps into the basic idea of learning, to go from what you don't, what you already know to what you don't know, and you can't, nothing is, is sort of brand new information or brand new concepts, or brand new techniques, they have to build off previous ones you know, to really learn something, and so I think this helps to visualize that process you know, so it could be about the subject matter and showing interconnectedness of ideas but I think it can also just be a, a almost a visual representation of the learning process about that concept or subject potentially. Of course, you know, I'm sure it all depends on the quality of the infographic and so, but the potential is there, I think for anything to do this, so that could be that outcome.

Frank continued to describe his perceptions about the thinking and learning associated with developing an infographic. He commented,

It really got me kind of, I can't think of the metaphor I keep searching for, firing on all cylinders, or juices flowing, something in that, there's one I want that I can't call out, but, but it really, I mean, it got me thinking about things in, in, a different way.

He reflected on how he thought infographics influenced and facilitated learning stating,

It's a way of thinking about them, thinking through them, again, getting to

a level of conceptualization and if can get students to take content and

start to create with it, conceptualize it and apply it or

whatever, then that's deeper level learning that we all want to get to and so, so

yeah, the potential is there to do that in ways that you know, you might not be

able to do otherwise, and you know, in a fun and different way.

Frank had initially questioned why an infographic should be constrained to

a single page. He talked about how the process of condensing the infographic to

one page contributed to learning. He explained,

 I understand now the value in that, better understand it because if I had broken it

up, the concepts that I was putting, trying to put in that one infographic, if I break

it up, then I'm missing that interconnectedness and seeing, you know, seeing it

you know, side to side, front to back, all of it together and so I think that's the

value for students as well, that they will be able to, to see that, and need to see,

that.

Frank continued to reflect on his infographic development experience. He

describes challenges he experienced visualizing concepts to the point where other could

interpret and understand his intent, explained the representation of connectivity within the

content, and suggests that the process of developing the infographic helped him to better

understand the content.

 The real challenge though was that I, I realized that you know, I had to think of a

different way of communicating these ideas that I've gotten across, or tried to get

across to a class literally hundreds of times and yet I was thinking about it in a

new way that I'd never thought about before, because I had to bring more of a

visual element to it, metaphorical element to it, show the interconnectedness in a

way that I hadn't, thought I was before, but realized I hadn't taken it to that the

metaphor that I used which has helped me to see it differently and so I know I've

got to get that to the students now, I've got to have, being the type of person I am,

there's a layer of level of guilt involved in that cause, like wow, I'm just now

getting this and told thousands of students this, and maybe I never completely

understood it myself. But it was a challenge to bring that visual element to it, that,

not just a visual element, but a visual element that would work for somebody else,

to find useful and valuable, and so it helped me understand it better, and I would

hope it would understand viewers, to understand it better and for that.

Frank reflected on how the process of developing an infographic on a

familiar topic impacted his thoughts. He suggests that infographics may provide

an avenue for teachers to explore the way they teach their courses and providing

insight into alternative approaches for content delivery. Frank exclaimed,

It worked! And it took me out of that boxy, you know, I've done this a million

times sort of thing. And so it was a challenge but it was a really good thing for me

you know to push me out of old ways of looking at it and getting me out of a rut.

So, I mean like I said, I've, I've said it two or three times now, but I think, I

would think most educators ought to take a look at this as a way, just for

themselves, and, and you know, even if they don't even bring it to the classroom

necessarily, but just to think about, a different way of coming at their, their

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subject matter and you know, it may make a difference. And it did for me on that one small lesson so."

Further, Frank elaborated on how infographics might provide a different way to approach teaching.

This might provide the opportunity to come at it in a different way, and maybe in a new and better way potentially to show again, kind of the interconnectedness of ideas that it's, you know, we, we can look for them separately, but it's still all in one essay and it's still all working together, or supposed to be.

Frank describes the significance of the infographic based on his experience developing an infographic as part of the training.

The more I talk about it, the more I talk with you about it, the more I see the value. In terms of assessment and if, if I'm having these experiences using infographics, to make me look at things in a different way at least and maybe in a deeper way, then you know, why not bring that to help students have that same experience. Cause that's, I mean, that's the wow there, you know in education anyway when you're looking around the classroom and you can see that look on their face that they're getting it and it's that a-ha moment or whatever you want to call it, is and so I can see the potential for this providing that for students, so I'm excited about that so you know, definitely it's a, I won't go so far yet [emphasis] to say it's revolutionizing what I'm doing and how I'm doing it but it, it very well could. I mean, it's definitely something that I'm excited about digging in to.

Frank also shared his thoughts of the infographics potential impact to post-secondary educational practices.

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I hope it's not coming across that I'm trying to like, pump this up to, to make you feel good or anything, but I really think it could be, I guess I'm going to go ahead and use the word, I don't think it's overstating it, to be revolutionary, I mean for, for some instructors or disciplines, I think this could be, you know, something that they might ought to be doing instead of what they're already doing, the potential is there for it be, to really revolutionize what, how they come after concepts.

Teaching infographics – Frank. The most prominent comments in this area from Frank revolved around a teacher's ability to create an infographic, their commitment to use infographics within a course, and considerations involving types of disciplines and/or courses that might be better suited for infographic assignments. Table 32 provides an overview of Frank's perceptions about the process of teaching infographics.

Table 32

Teaching Infographics - Frank

Teaching Infographics - **Frank**	
Preparing to teach an infographics lesson (thoughts)	**Instructional practices (continued)**
• Teachers should understand how to develop an infographic	• Demonstrate, provide examples, work along with students
• Realize that it may not go well the first time	• Explain role of drawing/sketching; not about graphics
• Commit to planning and developing infographic components; commit to use	• Delay judgement; don't expect perfection
• Start small, some limited use	• Teacher uses infographics in class
• Have clear goals and communicate those goals	• Set clear goals and communicate those goals
	• Show students early design sketches of completed infographics
Planning and preparation	• Avoid the theoretical side
• Provide time for practice	
• Need time to learn before teaching someone else	**Learner support**
• Time for learning/dealing with the learning curve	• Teacher participation/involvement/support
• Practice what you preach, instructor use of infographics	• Develop training videos, webcasts
• Collaborate with other teachers	• Provide technology training for those wanting to use tech tools
• Read books about infographics	• Provide visual layout and organization assistance
• Should be a significant part of course; commit to use	• Be ready with ideas; help with visualization
Instructional practices	**Training environment**
• Provide examples/samples	• Highlighters, markers, pens, pencils
• Use groups	• Sticky pads
• Use a process, model, approach	

Frank describes a situation where he believes that in order to teach infographics to students, a teacher needs to know how to develop one themselves.

> To be able to convey to others, an audience, concepts or processes or whatever and so you know I've got to do that myself for a while so I don't think even a short training, a PD [professional development] or two would be enough for me to feel like I could take it to students as something for them to do and to assess their learning based on that. I think I would have to do it myself a while, at least a semester of, of doing it myself before I would feel comfortable, and you know it may just be me, you know, somebody else may be able to jump in with both feet and take to the students right off, or maybe that would be part of your, your training ultimately, is how they might do that without necessarily having to have their own long learning curve.

In addition to knowing how to develop an infographic, Frank believes that like teaching in general, a teacher needs to be able to demonstrate the concept being taught and be ready to assist students as they develop their own infographics.

> I think it's just a, applies to teaching in general, any sort of teaching, I think if you're asking students to be able to do something you've got to maybe demonstrate it for them, model it, to some degree, so I think that you know, being able to you know, show them infographics, and not just a, here I want you to do something that looks like this because I mean, then you could just like pull things off the Internet potentially, and, or whatever, and show them that but I think being able to show them the process itself, I think if you're doing that as an instructor, I think a lot of the potential struggles that students might have can be overcome

because you're walking them through it, I think you have to be willing to do that probably to avoid some of those. There might be other ways but I think that's you know, the best way.

Frank thought that if infographics were going to be used in a course that they should be part of a larger commitment and teaching strategy used by the teacher.

I think it has to be a, a fairly significant chunk of a course or an element in a course. I think that there's enough of a learning curve to it, and time that would be devoted to just learning the process that you wouldn't want to do it for just a one-off kind of thing, or just one assignment, or one thing, I think you'd need to build in as something, it wouldn't have to be, dominate the course, but I think it would be something that to make it worthwhile, you'd have to commit to it, in a, in a bigger way, or you know, a significant way.

Frank's rationale for this extra commitment is grounded in how he believes that learning and learning to develop an infographic may be simultaneously beneficial to the learner.

I'm kind of thinking about two or three things at once here but I guess bringing it back to my own experience I could see, again, you would have to commit to the infographic beyond just doing it a time or two or three. I think it would have to be something, because they're going to learn better how to do the infographic as they go along, but it's really about learning the material and the better they learn the material, then the better, the more they can bring to the infographic and so I think as, to use it as an assessment tool, to determine outcome, you do have to factor that in, the infographics are going to get better as they grasp not just infographics but

the knowledge itself and so I think you, you, may have to adjust how you assess things.

Frank then reflected on how the infographics assignment is similar to his writing assignments in terms of how he increases his expectations as student learning progresses.

> If you're using it [infographics as assessment] as an instructor, I think you have to, and I'm, I'm trying to decide though if that's really that different from anything else because I guess I do have in writing assignments, I might have lower expectations early on, you know, in terms of what I'm expecting them to produce until they've gotten feedback and, and more practice at it, that they can't they can only do so well until they've gone through the process a few times.

Frank was concerned that the time commitment necessary to work with an infographics assignment might take time away from other activities required by the type of course.

> I would just be concerned that I would, and I hope that I'm not jumping ahead too much, but my concern is that it might so much to teach them about infographics, and the process, and the technique, that it would be taking time away from their writing, you know, the text-based stuff that is really our primary goal and so I don't know if that would be worth it for me to use it as a student activity or a student assessment but certainly I could see where it would be useful as a way of communicating ideas to them. You know, so but again, I'm new to it, I'm not dismissing it out of hand, or anything, but I just haven't dug into it enough to see how to make that work without it being cumbersome or too time consuming.

He adds further,

You know where I said you'd need a whole class period I would think to really

teach the process, the what it is, and how we're using it in class, so that's a

commitment you know, you only have so many class periods, you know, we all

tend to think that what we're doing now is, you know, how do we give up, find

that time for it, so you know, yet another obstacle I suppose.

Frank posited that class type, course discipline and subject play a role in teaching

infographics. He thought that certain subjects might be better suited to an infographic

assignment than others."Yeah, I think the possibility is there, again, maybe more so with

some subjects, disciplines than others, possibly although I'm not sure about that…"

His rationale behind this distinction in subject type considerations are evident in his

description of his subject area (composition) compared to other subject areas or class

types.

I could definitely see for a class, a type of class or discipline that involves, what

do I want to say here, the content just acquiring knowledge you know, so anything

that you might test for or, you know, ask students to convey a process, or a set of

facts, or just information in general, I could see, that more easily, how this would

apply to that. For something like essay writing though, where it is, so text-based

to then try to come up with visual forms for that I think, and again, I mean you

know, I would just need more time with it, more work with it, I wonder how

much I would be able to use it.

Assessing with infographics – Frank. Frank thought that infographics could be

used as an assessment of learning and could be used as an alternative way to assess his

students. Table 33 provides an overview of Frank's insights into assessing with infographics.

Table 33

Assessing with Infographics - Frank

Assessing with Infographics - **Frank**	
Thoughts about assessing with infographics	**Suggestions for assessment criteria**
• Good way to evaluate learning/demonstrate understanding • New way of learning/measuring learning/something different/more interesting/alternative way of assessing • Quicker, more efficient form of assessment • More authentic assessment of learning; hard to fake/cheat • Use a rubric	• Grade content independent of artwork/graphics quality • Depth of understanding displayed, key concepts clearly communicated • Level of detail; specific facts • Understanding of process, logical connections; thinking • Audience considerations • Elements of application • Clear goals
Factors influencing assessment	
• Grading challenges/considerations • Concern about rubric for grading • Instructor understanding • Class type considerations • Graphics quality has potential to influence grade	**Other assessment suggestions** • Lower expectations early on; less emphasis on grade • Incorporate as part of way students are introduces to content and subsequently assessed

Frank cautioned against grading the graphic quality of the infographic and suggested focusing assessment on the content of the infographic.

> We could definitely get at, use this as a way of, getting at some of the same concepts and assessing, how well they're attaining, and again it might even bring up a different wrinkle to it…This [using infographics] might provide the opportunity to come at it [essay assignment] in a different way, and maybe in a new and better way potentially to show again, kind of the interconnectedness of ideas that it's, you know, we can look for them separately, but it's still all in one essay and it's still all working together, or supposed to be.

Frank indicated that there might be the potential for the quality of the graphics used in an infographic to influence the grade.

I definitely see the potential here and maybe more so than other things, maybe to be picky about it or, to be, or to, to not be, if you don't have clear goals about what's important, what's not, then you could get into like, you know, the picture's not being big enough or the, to use this one on the front page, oh this arrow is not really pointing where it ought to point, you know, and get into things like that so I guess the potential is there for people to assess things that don't really matter to their, you know, goals for the class or the discipline, the key concepts.

He further explained that it should not be about the graphics at all. Frank emphasized this concept several times during the interview. He said, "…You'd want to steer clear of grading on their artwork or you know, that sort of thing, but the concepts would have to be clearly communicated…"

Frank added,

Oh yeah, it's definitely, it's got to be about the concepts, otherwise it's going to become about the art, it's going to become about the end product, the presentation, how fancy it is, how pretty it is, how artistic and that's not the goal, it's, we can't make it about the graphic over the info. It's got to be the info over the graphic.

He continued,

I'm sure someone who's very skilled at artwork might you know, get a bit of a leg up, or visually BS their way to, to some degree, I think you know, it's all there on

the page though, so if the content's not there, I think, so I don't think the artwork would be a problem as far as assessment, it shouldn't be.

Frank continued that the emphasis of the infographic was about the content contained in the infographic.

> But it is more about the info than the graphics, I think people would get too hung up on the graphics potentially could get too hung up on that or be dismissive of it…You have to focus on that, that it's really about your content and the concepts and that it's a way of thinking about them, thinking through them, again, getting to a level of conceptualization and if can get students to take content and start to create with it, conceptualize it and apply it or whatever, then that's deeper level learning that we all want to get to and so, so yeah, the potential is there to do that in ways that you know, you might not be able to do otherwise and you know, in a fun and different way.

Frank cautionsuly suggested that there might be graphical elements of an infographic that could be graded. He said,

> I wouldn't grade it on their artwork but, I think you could certainly assess them on their, you know, factor in their attention to detail, in terms of that, so I guess you've got to be careful with that though cause I guess it'd be easy to go from you know that to well these stick figures, you could've made this, it could've been better you know, and then it's like okay, are you really grading, you know, their attention to detail or are you grading their artwork so?

Developing infographics – Frank. Table 34 provides an overview of Frank's thoughts about skills required to develop infographics.

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Table 34

Developing Infographics - Frank

Developing infographics - **Frank**
Skills required • Ability to visualize and graphically represent concepts • Basic art skills/abilities • Understanding of content • Design, layout, and organization skills **Other considerations** • Drawing over technology tools ○ Reason – lessens the learning curve, simpler, more efficient ○ Reason – more instructional benefits from drawing ○ Reason – more cost effective; cheaper

Visualizing ideas. Frank suggested that the ability to visualize ideas might create a challenge for someone trying to develop an infographic. He reflected on his own development experience emphasizing the importance of understanding the concept being developed in the infographic. Frank shared,

Yeah, I think they have to, and again, this goes back to one I was having trouble sort of articulating earlier, or even just thinking through that to visualize something to the extent to where you do an infographic you've got to understand it pretty well already.

Frank added,

Where I had my own struggle, for me it was breaking away from what I'd done before and to re-imagine it, they might need help imagining it to start with, like to, you know, what sort of visual metaphors might you use, or what sort of you know, how might you organize these things and so, yeah, that could be a struggle for them and you might have to, you know, be ready with some ideas for them,

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encourage them, you know, to tap into, cause I think that's part of it if you can

kind of come up with your own things and be creative about it, you bring that

creativity to the subject matter and now you're, you know, really got something

cooking, but yeah, I think with some assignments you would have to be willing to

you know, why don't you try this, why don't you try that and be ready, be ready

with that I think.

Frank also commented that creativity may be an innate ability that at some point

along the way we lose our ability to be creative. He said,

It kind of took us, we were all talking about you know, being in kindergarten and

working I mean, which is good because we, we start out as so visually creative

and that is encouraged and then it gets sort of beat out of us along the way and it

doesn't have to be that way. So it sort of, you know, tapped into something that

we all had at that point.

Frank suggested that the infographic development process involved

several phases. He thought that understanding the concept was essential but that

knowledge would need to be conceptualized and ultimately communicated

visually.

 I think conceptualization probably would be number one and you know, people

would assume their drawing skills first in looking at it, but it's really about being

able to, big picture, you now, relating things to one another, interconnectedness,

flow, whatever it is, being able to, to see it all, in some way and then, once you

can kind of see it all, then you've got to communicate what you see whether it's

metaphorically, so yeah that would be the, you'd have to be able to do that, and so

understanding a concept or understanding content whatever is important, you've

got to have that, but, then I think it's a, it's another level beyond that to

conceptualize it and maybe another level beyond that to put it in a form that

others can see it, see what you've conceptualized, so yeah, it's talking about

multi-level thinking.

Drawing versus technology. I asked Frank his opinion about using drawing or

sketching for developing infographics compared to an approach that utilized technology.

Frank thought the sketching approach would be better than utilizing technology for

developing the infographics.

I think that the sketching is probably the better approach than if you had students

to do infographics that were totally computer-based and they're pulling in clip art

and it's all done in PowerPoint, I don't think the, the potential gains, the benefits

from doing that, I don't think, probably, again you know better than I with your

research, but I'm guessing that there are fewer benefits doing it that way than

doing the, the sketching.

Frank added that sketching might provide additional learning benefits for student

stating,

I would think that's the case and that it, there's more benefit, because it's more

hands-on, and you're there and you're literally making the connections yourself,

you know, if you're drawing the arrows, or doing whatever, it's, it's, that's a

different thing altogether, so I think if you do it on a computer it becomes more

about presentation, more about technology and less about working with the ideas

so there, I think the hands-on element's important to it.

Frank continued describing the potential benefits associated with a sketch-based or drawing approach for developing infographics.

So I think in general, that the sketching, and I may be going way out there at this point, but I think that studies have demonstrated that, you know, when you're writing something, that it like fires up part of your brain that there's that, that would be different than if you were typing it or certainly just listening, that writing it is, you're engaging a different part of your brain.

Frank mentioned that adding technology would have impacts to the learning process associated with infographics stating,

Yeah, well, and one other thing I'll add then just to make this new, is that some students, there's a learning curve with technology as well, so, I mean, if they're already having to learn about infographics and, and being taught the value, and then they have to learn the technology to make, make it happen with the infographic, I just think to sketch it out you know, lessens that part of the learning curve.

Frank cautioned that students might not have the technology available to develop infographics and that using a drawing or sketching approach could make the technique more accessible to students. Frank said,

I think for students that don't have access to the technology necessary to do something, you know, do all that they would want to do, like the computer-based or whatever, infographic, then there's that too, so, I mean, it's a cheaper thing which students like and need, and I think there's actual, you know, demonstrative,

better learning going on, or more, better possibility for learning because of the hands-on nature of it.

Participant Viewpoint - Jerry

Jerry is a professor within the business and professional services discipline with over 16 years of teaching experience. Jerry is very familiar with information visualization and infographics having utilized visual communication methods both in his professional experience and in the post-secondary educational context.

During the infographic training, Jerry developed an infographic describing a major topic in his introductory classes. Figure 27 displays Jerry's infographic. The purpose of Jerry's infographic was to provide students with an overview of a fundamental course concept. His depiction shows important concepts and how these concepts are related.
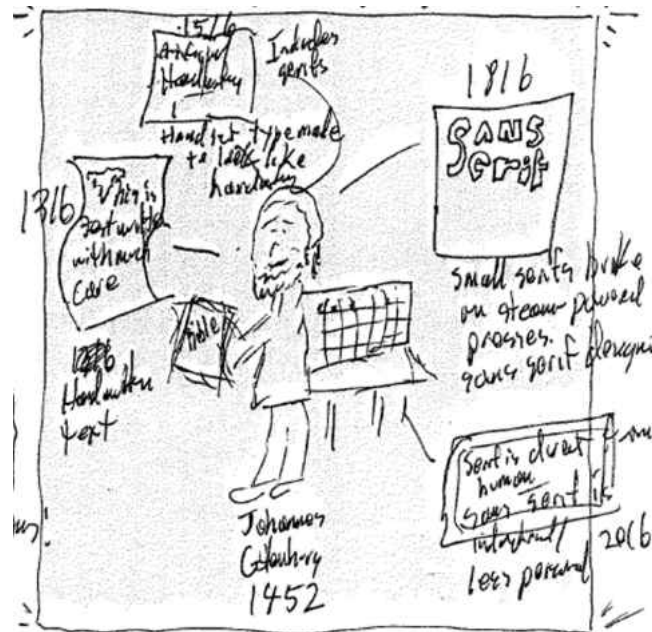
Figure 27. Jerry's infographic

In this section Jerry's thought and insights about using infographics as an alternative form of assessment in post-secondary education are explored. This overview of Jerry's experience is intended to provide insight into the major concepts that Jerry shared with me during the interview process. Each section contains a table and/or figure displaying the concepts he mentioned along with a more detailed description of areas that he emphasized. The graphics in Figures 28 and 29 illustrate how Jerry perceived his infographic development experience.
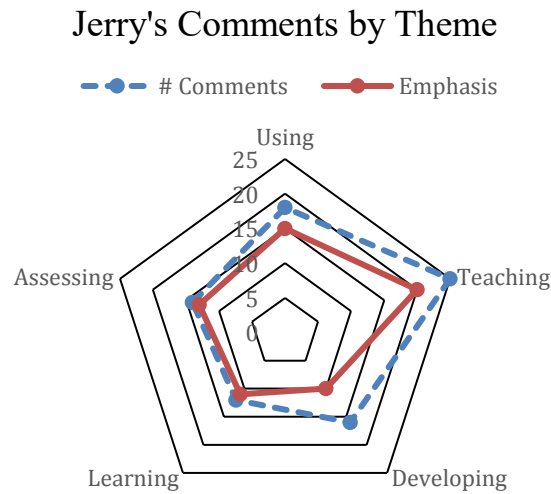
Figure 28. Jerry's comments and emphasis by theme – radar chart. The dotted line in the figure represent comments made by Jerry related to the themes of this study. The solid line represents areas that Jerry emphasized.
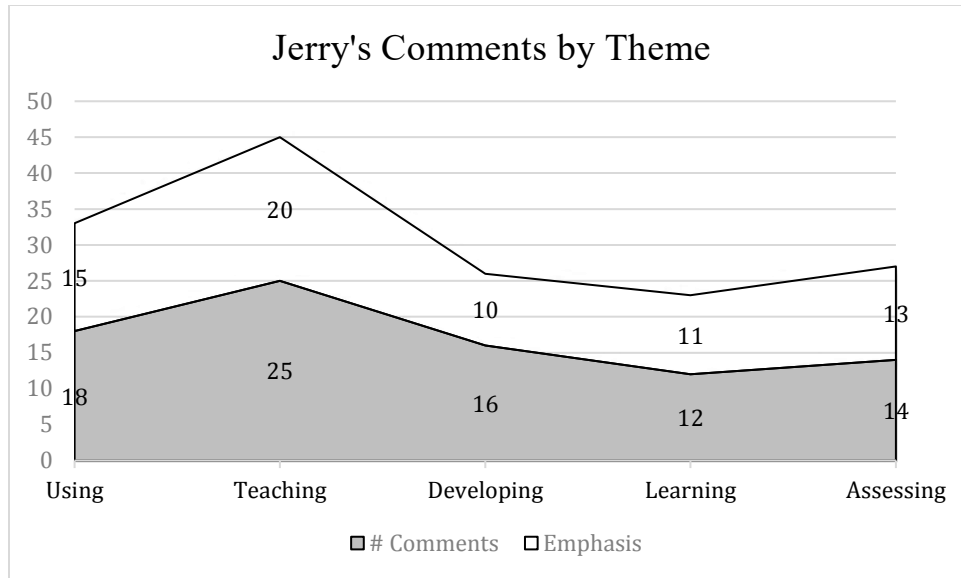
Figure 29. Jerry's comments and emphasis by theme – area chart. The area at the bottom of the graph displays comments made by Jerry related to each of the study themes. The area at the top of the figure provides additional comments made by Jerry emphasizing comments and themes.

Jerry's experience and insights are displayed graphically by theme in Table 35.

Table 35

Jerry's Comments and Emphasis by Theme

	Theme	# Comments	Emphasis	Total
T	Teaching Infographics	25	20	45
U	Using Infographics	18	15	33
A	Assessing with Infographics	14	13	27
D	Developing Infographics	16	10	26
L	Infographics and Learning	12	11	23

His thoughts about the infographic development experience are concentrated in the themes of *Teaching Infographics* (T) and *Using Infographics* (U). Concepts associated with *Assessing Infographics* (A), *Developing Infographics* (D) and *Infographics and Learning* (L) follow close behind. Figure 29 graphically displays the concepts that Jerry mentioned and areas that he emphasized. For example, in the

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Developing Infographics theme or *Developing* for short, Jerry mentions several concepts

but does not elaborate or emphasize the concepts he mentions as much as what is seen in

the Teaching Infographics theme.

As described previously, this organization by themes is resultant of an analysis of

the codes developed from the interview transcripts and then by emphasis provided by the

participant as reflected in the transcripts. The following overview of Jerry's experience is

arranged based on this organization by theme.

Teaching infographics – Jerry. Teaching infographics was a key theme for

Jerry. He mentioned several concepts related to this theme. Table 36 lists Jerry's

comments related to the teaching of infographics.

Table 36

Teaching Infographics - Jerry

Teaching Infographics - **Jerry**	
Preparing to teach an infographics lesson (thoughts) • Teacher should understand how to develop an infographic • Understand that there is a learning curve **Planning and preparation** • Provide time for practice • Don't move too quickly; spend some time • Practice what you preach; instructor use of infographics • Be mindful of time given for assignment • Use in multiple classes • Determine whether to provide data or student researched **Instructional practices** • Teacher uses infographics in class • Provide examples/samples • Use groups • Use a process, model, approach • Start small, simple, slow	**Instructional practices (continued)** • Demonstrate, work along with students • Explain role of drawing/sketching; not about graphics • Delay judgement, don't expect perfection, permission to screw up • Use technology/internet/images/clip art; other media • Make it fun • Be up front about time commitment • Drawing practice/training **Learner support** • Provide tools, resources, cool stuff • Provide students with design template, design options • Selecting the right visualization **Training environment** • Individual whiteboards/dry-erase boards

Jerry's comments regarding these concepts associated with infographics focus

more on the planning and preparation, and instructional practices involved with teaching

infographics. The concepts Jerry emphasized include the teacher's understanding about

how to develop an infographic, the teacher's use of infographics in class, the use of other media to develop an infographic, helping students with information visualization and allowing practice time for students.

***Teachers know how to develop infographics*.** Before teaching infographics to students, Jerry thought that teachers should be able to develop their own infographics stating, "…But teachers, if they don't understand it [laughs] the student's not going to understand it so you've got to start there…." He continued that instructor confidence in the infographic was important saying, "Well you have to be confident in your own infographics to throw some out as examples."

***Teacher uses in class*.** Jerry thought it important for a teacher to utilize infographics as part of the class instruction to familiarize students with the concept. Teachers could use infographics for "Communication with the class", as an example to explain how they developed their own infographics and as a way for teachers to show students that they also use infographics, or as Jerry said, "…You got to practice what you preach." Jerry thought that students could benefit from instructors using infographics as part of their instructional strategy.

> I think it's starts sort of like with the instructor providing, when the instructor uses that to give them information they're going to see how it works, so I, you know, giving them a background a little bit on why you're using certain graphs or whatever, the information, so I think once they figure it out, it's fun [laughs]. I mean, there is a fun factor to it and once they get to that part, you know, you get over the knowledge, the collection of the information, you figure out how you're

going to, how to best present that information in a graphic form, you know, then it gets kind of fun.

He adds that showing example of infographics as part of instruction might provide a way to engage the students and progress into a new form of instruction.

Show them quick and simple infographics that get their attention and show them what you're talking about but as you move on say all this seems like it would be a process for an instructor and students to get involved in this type of instruction, it's different and it takes more time but you get more, more learning out of it.

Selecting appropriate visualization. Jerry's suggested that students might need assistance in selecting and using the right visualization to convey the topic they are learning. Jerry stated,

Well, like we said before, it's a learning experience for the student so one of the processes, knowing what I think you almost have to have a class first, and we did a little bit, you know, you showed us different variations of an infographic, maybe get into that more with the student, you're going to have to show them you know, if you have this type of idea or these types of facts you would want to use this type of information to promote that or show it and as I said that was a problem with me and I think it would be for a lot of them they may know, they may understand it but getting the right way to put it into an infographic format it's just like you know, whether you want to use the type of chart you use, a pie chart, or a flow chart, or a bar chart, you know, different information works a lot better in the different ones, it's understanding that would be a part of their thought process.

Time for practice. Jerry indicated that time for practice teaching with and developing infographics,

> I've learned that in the end you know, it just takes practice. And I think you mentioned that in the training that one of the examples you gave was of an instructor who finally just put the worrying about it beside her and did so much better. And I know it makes since but it's harder to do because you know that people will be looking at your little drawings. So [laughs] it's harder to put it away than, than I thought it would be but. It just takes practice and getting used to.

Using groups to develop infographics. Jerry thought that using groups might provide a way to help students learn how to develop an infographic.

> I think groups help with this because you'd have to understand your subject. This way you've got two, or three, or four people throwing it around and I think you can get to the understanding of what you need to, the information that you need to set it out there and you, and you feel comfortable with it if you can get a group to go with it.

Using infographics – Jerry. Jerry's thoughts about using infographic in post-secondary education focused on the potential advantages of using infographics in today's classroom and reflected on potential challenges associated with teaching and learning with infographics. He also provided an instructional-focused use for infographics. Table 37 provides a summary of Jerry's insights about the factors influencing infographic use.

Table 37

Factors Influencing Infographic Use - Jerry

Factors influencing use of infographics in post-secondary education - **Jerry**	
Teacher influences	**Student influences**
• Teacher not open to trying something new	• New generations of students
• Instructor understanding content enough to develop infographic	• Potential resistance from students
• Moving away from lecture	**Skill influences**
• Extra work involved	• Drawing skill set/abilities
• More difficult than traditional instruction	• Visualization skills and abilities
Curriculum influences	
• None provided	
Time influences	
• Takes time to learn (learning curve)	
• Time and effort required	
• Time away from content; having to work in	

Jerry reflected on things that might influence the use of infographics in post-secondary education. He thought that infographics might be a way to provide instruction in a form that is becoming more pervasive in society. He said, "I believe we're going to see more of it [use of infographics] everywhere in the future. And you know, it's a more visual environment we live in so, this is a, a good way to get information out and understood." Jerry also thought that infographics might be a way to provide information in a form that captures interest saying, "It's, people look at it, you know, it's like a cartoon. People look at that first, it draws your attention because they know it's going to be something easy they can understand, they're used to that anyway."

He also provided some insight into how infographics might become another valuable instructional option for teachers. Jerry said "...it makes you look at your subject more, what you're instructing, and it just offers up some more opportunities for you to provide instruction." He continued,

I'm sure every instructor is going to have certain things that they're providing instruction on, that this is the best way to get that information to the students. So even if they don't use it much, it's good to have in your bag of tricks to, for instruction.

Although Jerry shared factors that might encourage the use of infographics in post-secondary education, he also thought that there were some challenges to their use. Jerry shared that he thought that the learning curve and time needed to learn about infographics would provide challenges from both the teacher and student perspectives.

For a student to do this, it, it's going to take a learning experience on both sides and it's going to take time to develop that and it's almost like something you would like to see done if it's going to be done, do it in more than just one class have the student, it's sort of like our, designing our Blackboard, if you have it all, the same setup in all the classes, the student's understand it, if you have this type of assessment a little bit in all classes they're going to start to understand it. But if just one teacher out of the blue has them try to develop or learn and develop and understand and put together infographics in one semester, you know, that's tough to do, and they may understand it at the end of the semester, or start to understand it and then, then it goes away, so, it would be a good thing where a, a division or something tried it for a while to see how, how it could spread around.

He also mentions challenges from a teaching standpoint that might influence the use of infographics stating, "Well you have to be confident in your own infographics to throw some out as examples and it is a you know, it's a different thing, you have to work through it…"

Jerry discussed that teaching infographics might be harder than lecture and would involve extra work from the teacher. He says, "Yeah, it's just getting their minds set to work with it because it's a little different than what they've done before, it's a different type of instruction." Jerry thought that the learning produced is worth the effort.

Infographics is sort of like our critical thinking, it takes a little extra work, you have to break things down to the basics, to understand, you have to truly understand it to be able to do it, so it's extra work and when you're you know, it's trying to, when you're doing that with students and trying to get them to do that extra work to understand, it's harder than just going up there and doing normal instruction so it takes a little more effort but you do get more out of it.

He adds that the learning resultant from the infographic might be retained longer than that produced by traditional instructional methods.

It takes some work, it's not like just standing up there and lecturing it off. But when you lecture it off, three weeks later they're not going to know what you're talking about, but if you get them, get an infographic in their hand, three years later they're going to be able to look at it, or even thirty years later they're going to be able to pull something out of it that says, yeah, I understand what we're talking about here.

Infographic uses. Jerry's example of use for an infographic is focused more on the instructional usage of infographics in the form of instructor or presentation notes. He described, "I would like to see an instructor provide notes instead of a PowerPoint, provide an infographic that the student can walk through you know, look at and keep."

He elaborates on this concept describing an instructional strategy involving instructor use of infographics to introduce concepts followed by student development of infographics.

> It goes both ways, the instructor, if they provide the notes like that, that gives the student an overall look at with the specifics and even better for the student, when they're designing it themselves, you know, they have to, you have to think of the big picture before you really get going.

Jerry expanded on this concept of introducing students to the concepts of infographics by using infographics as an element of instruction first before asking the students to develop infographics of their own.

> I can see the instructor providing their notes in infographic form but when you ask the students to respond with their work I, I, I think that takes it up a whole another level and I think it's hard to work that into a semester. You know if you had like a beginning class where, or a, a first class where the instructor, and I don't care what it is, gives their notes in infographic form so the student gets used to that and maybe have them do a little bit of it, you know in that class, I don't care if it's calculus, or anything, they get used to that format and then if you follow up with it and as they go to a, you know, to a higher level class, you get more into them responding that way, they're going to understand it and all that.

Jerry also talked about using infographics as a way to communicate information about an academic program explaining, "I'm wanting to do a yearly, or not a yearly but a breakdown, some kind of an infographic that shows students going through the visual communication program…"

Assessing with infographics – Jerry. Jerry expounds on the assessment of learning provided by an infographic and provides insight into inherent challenges that might be associated with an infographic assignment. Table 38 displays Jerry's thoughts about assessing with infographics. The challenges include an instructor's understanding of a given subject enough to assess student work, an instructor being able to understand and interpret student visuals, the potential for placing too much emphasis on an infographics assignment and the potential for the quality of the graphics to influence the grade.

Table 38

Assessing with Infographics - Jerry

Assessing with Infographics - **Jerry**	
Thoughts about assessing with infographics	**Suggestions for assessment criteria**
• Good way to evaluate learning/demonstrate understanding	• Depth of understanding displayed
• Quicker, more efficient form of assessment	• Level of detail, specific facts
• Use a rubric	**Other assessment suggestions**
	• Lower expectation early
Factors influencing assessment	• Use in multiple classes
• Grading challenges/considerations	
• How to grade fairly	
• Instructor interpreting student visuals	
• Placing too much emphasis	
• 'Tricky'	
• Graphics quality potential to influence grade	

Jerry's thoughts about using infographics as an assessment of learning focus on the capabilities inherent with the infographic to measure learning and the challenges associated with grading an infographic, Jerry thought that infographics could be a good way to measure understanding,

Oh yeah, it shows whether they understand [laughs] the topic. You know, even

though we say, you know I said earlier that the students' vision of it in an

infographic might be abstract and a little off I think you know, if the teacher just

wrote back and said well you know, explain that to me, you know, if the student

could, sure, but it's still a way of determining whether their overall understanding

of a topic or a whatever is accurate so yeah, I like that, as I said before, to be able

to an infographic half-way right, you have to understand your subject so, that's

just good instruction.

Jerry describes the benefits of using an infographic for assessment but cautions

potential challenges, "…Assessment again is the tricky part. I think it's a great

assignment for determining whether they understand the subject or the, what you're

working with but…" The 'but…' referred to by Jerry includes several factors described

in the following sections, that he thought could influence the grading of an infographic.

Instructor understanding of subject and student's infographic. Jerry talks at

length about how grading an infographic could be complicated by an instructor's

knowledge of the subject, the instructor's ability to understand the visual and graphics the

students utilize in their infographic. He also is concerned about the amount of emphasis

that an instructor might place on this type of assignment suggesting that there is a process

and progression that might need to be followed. In his description he references a critical

thinking activity called SEEI for comparison and illustration.

Assessment is always the complicated part of this, you know you're going to look

for specific areas of facts that are part of what you're trying to provide the

instruction on, but you also you know, sometimes the, it's sort of like the SEEI

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[critical thinking activity] that we've done, sometimes the student will have something in mind that really goes with [laughs] the infographic that maybe out of your range of knowledge or you know, outside of your understanding of it, they understand it completely, but there's a link between what they've drawn and what the subject is, but you might not get that link so it is tricky to assess,. Of course as they get better with it and do it more you know, they would make it more general maybe where everybody's going to understand it, but when they're first doing this I can see, and that's why I think with assessment, just sort of like the SEEI, you don't want to give to many, too much emphasis to this, even though I think it's a very good way of learning, at first anyway you want to be lenient into their, how they interpret the facts and put them into a infographic.

Jerry elaborates on this concept of an instructor having difficulty interpreting the student's infographic.

Well, one thing is the instructor's not being, understanding the subject to assess it because they have to understand this concept or lesson or whatever as well. Of course that's in anything, but I think even more in this which can be abstract a little bit so an instructor really needs to understand it before assessing.

One of Jerry's concerns that he mentions involves the concept of emphasis being placed on the infographic assessment.

Yeah, my concern would be an instructor putting too much emphasis on it cause I think, as I said before a student could have a different idea of the correlation between what they're, the infographic they're doing in their mind it could work whereas they may not be broad enough in their thought to explain it to everybody

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so I think you have to be a little careful assessing, or not put too much emphasis on it.

Regarding the concept of emphasis, Jerry provides some suggestions involving a progression of using infographic for assessment,

You don't want to give to many, too much emphasis to this, even though I think it's a very good way of learning, at first anyway you want to be lenient into their, how they interpret the facts and put them into a infographic.

Jerry expands on this concept of emphasis,

Oh yeah, the benefit, as I said before, they have to study it, I just wouldn't put too much emphasis, you know, on the grade of it until they understand the concept [pause] and later on in the class you're going to have to start simple, course that's the way with anything but this is a, sort of a major change.

Jerry thought that a rubric could be used to provide guidelines and structure for grading an infographic assignment.

I think you could work up a rubric that sort of gives you areas that you want to see as part of it, you certainly would want to see some depth, you know, and you could include that in your rubric you don't want to just see one little picture unless it's very, very well done but, but you want to see some other areas so you'd have to work with it but I think you could have a structured way of interpreting it where you could give assessment.

Jerry continued,

Because there's so much information that can be in an infographic I can see a lot of instructors putting a lot of emphasis on it because of that and I think it's good

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to have guidelines to start out slow with that until the instructor and the student

understand what's going on you know, then you can start really assessing it more

in depth. But yeah, I like that idea of providing a rubric or some kind of

guidelines to assist with that cause I think instructors are going to be wanting that

[laughs] cause they're just going to, it's sort of wide open as to how to assess it.

Potential for graphics to influence grade. Jerry cautions that there is a potential

for the quality of the graphics on an infographic to influence the grade. He describes a

situation where the quality of the infographics may influence the grader even though the

information in the visual display may not be as strong. Jerry stated,

That's why I said, the assessment's the tricky part, and, and I think you're right if

someone comes in with all these bells and whistles and flash and jumps around

you know, the instructor's going to be impressed whether the [laughs] information

may be a tad weak.

Developing infographics – Jerry. Jerry describes a process of developing an

infographic that involves understanding of the content, is dependent upon the ability to

visualize and graphically represent concepts so that someone else can understand what is

being conveyed and is influenced by the ability to select and utilize appropriate data.

Jerry suggests that there might be alternative ways to produce an infographic that might

result in similar learning outcomes. Jerry's thoughts about skills associated with

developing infographics are listed in Table 39.

Table 39

Developing Infographics - Jerry

Developing infographics - **Jerry**
Skills required
• Ability to visualize and graphically represent concepts
• Basic art skills/abilities
• Understanding of content
• Research skills
• Select and use appropriate data
Other considerations
• Drawing over technology tools
o   Reason – as a design aid
• Technology over drawing tools
o   Current generation of students
o   Finding images, clip art, other media
o   Program/course type
o   More familiar with technology

Infographic development as a process. Jerry touches on a three step process that he believes is necessary to develop an infographic. This process he describes involves (1) understanding the content, (2) visualizing the content, (3) drawing or illustrating the content. Here is how Jerry explains the process,

> Of course the challenge is just to…first is understanding it, then to figure out the way to explain it, then having the guts to write it out, or draw it out, and what aspects did you find easier or more…of course we had the luxury of knowing the subject, I think doing the research would be almost a lot of it for some students, the easier part, because they could, they could find the facts and what they need, it's expressing that, which takes another, another layer of understanding or talent.

Understanding of content. Jerry reflects that the development of an infographic relies on understanding of the topic being explored. He said, "Infographics is sort of like our critical thinking, it takes a little extra work, you have to break things down to the

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basics, to understand, you have to truly understand it to be able to do it…" adding that

the process involved with an infographic, "Makes you think about it [the content]."

He continues describing the overall experience is more about understanding the

content than the specific steps or processes used to develop an infographic.

Well the main thing is understanding your subject. I think if you can learn to

overcome what your dog looks like and put it out there and sort of get an idea of

what shape you want your infographic to take and that comes with experience,

understand the subject is the main one, I think the rest of it I think you can work

out with a little bit of practice and training but, bottom line is have your data, use

the correct data and information.

***Ability to visualize and graphically represent concepts*.** According to Jerry, the

ability to visualize and graphically represent a concept is a challenging aspect of

infographic development.

It's getting that, the type of graph that would best describe what you're trying to,

the, the knowledge you're trying to promote. And, and I think that's a lot of it,

and that's going to come with practice, understanding what graphs work best for

what situations and so, that was the big, a big part of my process and when I

finally came up with my idea of having one central, focus area and little areas off

of that it worked real quick after I got that but it was, it was getting from the, I

know what I want to talk about but how do I express that.

Jerry points out that even students in [Jerry's program] have difficulty in

visualizing ideas and communicating those ideas in graphical form.

Our students work in it, they should just pick it up immediately, but some of them

have trouble conceptualizing the, the infographic format even though they work in

[field associated with Jerry's discipline] so, I think other students are going to

have difficulty bringing that, working it out in their heads and understanding how

to communicate that way.

Selecting and using appropriate data. Jerry mentioned an assignment that he

used in one of his classes that required students to develop an infographic or some similar

form of visualizing information. He described that his students did not have as much

difficulty with the graphics portion of the assignment but they did struggle with using the

correct and appropriate data. Jerry thought that getting the right data for the infographic

is critical. He offered, "I think the rest of it I think you can work out with a little bit of

practice and training but, bottom line is have your data, use the correct data and

information." Jerry described his experience with data and infographics.

I know when we were teaching it the main problem we had was not the, the

graphics, you know, it's like you said, you could almost have anything if you tell

them what it is they'll understand it but it's getting those numbers right, getting

the information right that, that was the main problem we had, they had the

incorrect information before they did their design so promoting all that."

He expands on this idea,

I would spend a lot of time on how to get accurate information to use for their

work, because you got to, that's your foundation. If, if you're off on your

information, you're spending a lot of time [laughs] promoting wrong, something

that's wrong, so you, you got to get that first then and then you get into the…I

like the way you got it spread out here, you start with the little tricks and work

your way through it and have them understand it, that would be my only thing.

Jerry also points out that the way a lesson is structured will have an impact. He

provides a notable distinction of how the data for the infographic assignment may be

obtained using his own discipline as an example. The question becomes, does the teacher

provide the data or does the student research and provide their own data for the

infographic. An important distinction as Jerry describes,

> Okay, in my area, discipline, [identifies discipline] that's something that we have
>
> them do that in a couple of classes so we provide, usually we provide the data
>
> which is a little different than most times, cause you know, I think most times you
>
> would use this like you said in other general education, they would be looking up
>
> the data to put the information you know, to start from scratch where we're going
>
> to give them the data and have them put together the infographic that goes with it
>
> so, big difference there [laughs].

Using other media to construct an infographic. During the interview, Jerry

suggested that the use of other forms of media to develop the infographic might 'connect'

more with students than using a sketch-based, drawing approach. He points out that the

main goal is to promote learning and understanding of content and that the form used to

convey that understanding might not be important.

> The bottom line is understanding your subject so you're, whether you're drawing
>
> it out or you're explaining it or whatever, I think this helps you understand it
>
> longer, it keeps it in, you know, by doing this and the same thing with vis…you
>
> know and they might be able to use this and you click on that and it brings up a

picture of one of Gutenberg's Bibles from the 1560's or you click on this and get

an early photograph of a printing press you know, or the newer stuff, you click on

it you get a video, so they could work in all kind of multimedia as part of it.

Jerry expands on this concept by pointing out that, "They're drawing it in their

heads but then they're using media." and by using other forms of media, " you can

broaden it a lot more." He believes that students might benefit more from using different

forms of media and how that process might benefit them more than receiving the content

in the form of a lecture.

> And that's, and that would be another you know, we said earlier how students are
>
> going to connect with this more than they will with just a lecture. New students
>
> are going to connect more with the media using that, they might just the drawing
>
> taking it another step on because that's where they're looking at YouTube, flash,
>
> Instagram, all types of images, that's how they get their information so they're
>
> going to understand how to manipulate it and use it to put together their thoughts.

***Drawing vs. technology*.** Jerry commented that even though he was more

comfortable with technology applications for designing graphics he thought utilizing the

drawing approach was the best approach.

> Well I think that's the way to go [using the drawing approach]. It's, even if a
>
> student or an instructor is, understands technology well, I think you still have to
>
> have the basics, understanding I think sketching it out, you know it's like doing
>
> [designing a visual layout] you do it all on computer but still I'll sketch out a little
>
> design before I go at it and, and it's sort of the same way with that, no matter how
>
> complicated your infographic can be and it may not involve drawing at all, you

know, you still have to have that outline or plan to go with, so sketching it out is the best way to start I think. You know maybe as you get great at it [laughs], you can just pull in videos and not have to write it out but you know, like I say, I still, I've been doing design and stuff for years and I still draw it out a little bit on a piece of paper to get my idea, maybe that's, or draw it out on the computer, but I'm drawing it out, or sketching it out [laughs].

Infographics and learning – Jerry. Jerry's comments relating to the learning associated with the development of an infographic (Table 40) describe how infographics providing learning benefits to both the student and the teacher and promote an in-depth understanding of a topic, critical thinking, and a big-picture view of a concept.

Table 40

Infographics and Learning - Jerry

Infographics and Learning - **Jerry**

Emphasized Concepts
- Promotes critical thought, higher-level thinking, critical analysis
- Promotes in-depth understanding; perspective
- Promotes big-picture thinking; big-picture view
- Get more (learning) out of it

Other Concepts
- Reinforces learning; retention and recall; memory/study aid
- Encourages thought, deeper thought; rethinking
- Reinforces learning: retention and recall; memory/study aid
- Promotes visualization skills, visually communicate understanding
- Infographics as a teaching activity (student teaching)
- Find connections in content; conceptualize a topic, identify patterns
- Promotes information checking/vetting/research skills
- Fun factor

Improved understanding. Jerry reflected on his own experience developing an infographic on a topic that he knew well. He describes how his own understanding of the topic was improved by going through the process of developing an infographic.

> Well I, you know, this is a topic that I knew going in but this helps, as I say you break it down, you see, you look for connecting things, so I, you know I think it helped me understand it a little bit more. You know I knew it but when you see it all together it really, even for me, helps promote understanding of it, so, you know, I thought getting my dates in there for the timeline, it gives me a better perspective and understanding of the subject.

Jerry describes how developing the infographic might improve understanding about the topic, both from the viewpoint of the student and teacher. Jerry thought that in order to develop an infographic, a student would have to understand the topic.

> You have to get into the subject to understand it to be able to map it out like that so it encourages research, it encourages looking at little things that you might not have, you otherwise pass over but it encourages critical thought.

He thought that the process of developing an infographic could benefit both student and teacher understanding of a topic.

> Well I think, what I was saying before, it makes you take an issue and break it down to the basics and truly understand it if students do that or instructors do that [laughs] they're going to know what they're talking about a lot more.

Critical thinking. Jerry relates the learning associated with an infographic to a critical thinking activity that he has used before.

The purpose of SEEI [critical thinking activity] is to show that you understand a concept and an infographic can do the same thing, you have to be, you know, SEEI is breaking it down into parts, using it in a different way, and then, an analogy of it using it in the correct way, then analogy, [inaudible] you showing you understand the meaning, you understand how to use it, you understand it as an abstract and that's sort of what you're doing with a, an infographic, you're breaking it down and then bringing it back a different way. So I think you could use it in your classes.

Contributes to big-picture view. Jerry discusses how an infographic might provide students with a way to see the bigger picture of a concept and see the 'reason' for learning.

I think the infographic gives you, rather than, you know when you lecture or even a PowerPoint or something, you're giving them specific points of information where an infographic because of the way it's designed you can see it overall and, and I think that's important because a lot of people learn the bits and pieces but they don't see the overall reason for their learning and this provides it all on one, in one area where you can look at the little pieces and get those, bits that you need to know for the test but you also get the overall, why are we doing this, what, what, what's the purpose of, of, this instruction so I, I really like that about it because it, it, because I have a problem sometimes of just looking at the pieces and not stepping back where this forces you to.

Participant Viewpoint - Lisa

Lisa's is an Associate Professor in the Social Sciences. Lisa has been teaching for

six (6) years at the post-secondary level. She indicated that she had no prior experience

with infographics but was familiar with information visualizations such as mapping.

During the infographics training portion of this study, Lisa developed an

infographic as a study guide to prepare her students to take the final exam in her course.

Figure 30 displays Lisa's infographic. Lisa wanted to develop a visual study guide that

she could give to her students so they could use how each chapter connected to the

overall course.
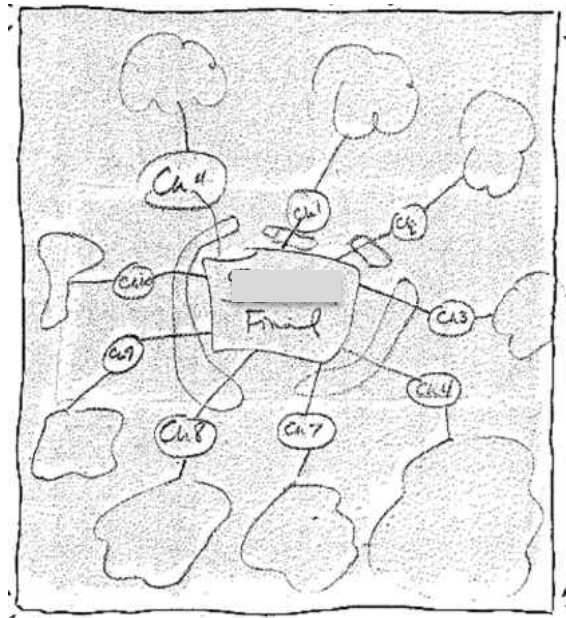
Figure 30. Lisa's infographic

In the sections that follow, Lisa's interpretation of the infographic development

experience is revealed. This section provides an overview of her experience and explores

the major areas that surfaced during the interview. Figures 31 and 32 provide a visual

representation of the concepts Lisa mentioned along with the areas of emphasis she

provided during the interview.
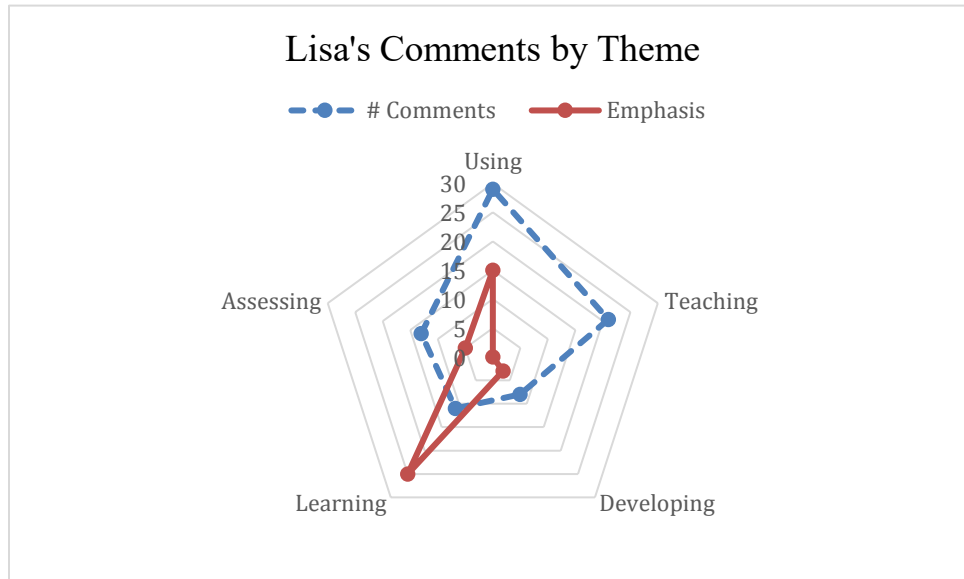
Figure 31. Lisa's comments and emphasis by theme – radar chart. The dotted line in the figure represent comments made by Lisa related to the themes of this study. The solid line represents areas that Lisa emphasized.
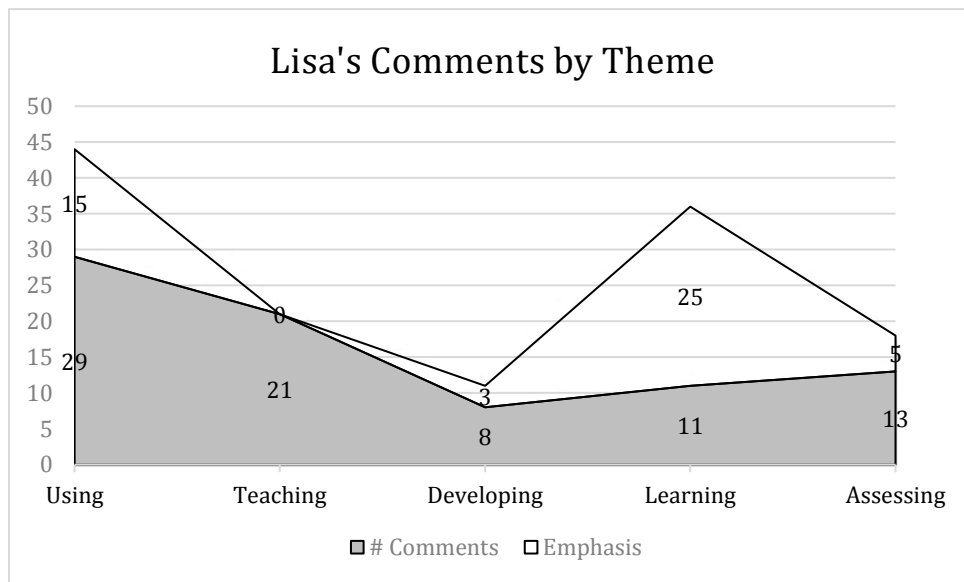
Figure 32. Lisa's comments and emphasis by theme – area chart. The area at the bottom of the graph displays comments made by Lisa related to each of the study themes. The area at the top of the figure provides additional comments made by Lisa emphasizing comments and themes.

Table 41 displays a tabulation of comments Lisa contributed by theme.

Table 41

Lisa's Comments and Emphasis by Theme

	Theme	# Comments	Emphasis	Total
U	Using Infographics	29	15	44
L	Infographics and Learning	11	25	36
T	Teaching Infographics	21	0	21
A	Assessing with Infographics	13	5	18
D	Developing Infographics	8	3	11

Lisa's experience classification is U-L-T-A-D. This classification means that Lisa's had more comments associated with the theme *Using Infographics* and *Infographics and Learning* more so than the themes of *Teaching Infographics*, *Assessing with Infographics*, and *Developing Infographics*.

As illustrated in Figure 32, Lisa touched on each of the key themes of this study. She emphasized several concepts but her primary focus was on the infographic impacts to learning, factors involving infographic usage in post-secondary education, and developing infographics. She also discussed thoughts about the assessment process and using infographics for assessment in her discipline and in post-secondary education in general. She did not focus as much on the teaching aspects of infographics in terms of the overall discussion but she did provide several teaching suggestions. These suggestions are located in the detail tables that are included in this section.

Using infographics – Lisa. Lisa describes factors that might influence the use of infographics in post-secondary contexts such as the potential resistance from students for an infographic-type activity, potential resistance from teachers. She also describes how

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infographics might be utilized in post-secondary education. Table 42 displays a list of factors Lisa mentioned that might influence the use of infographics in post-secondary education.

Table 42

Factors Influencing Infographic Use - Lisa

Factors influencing use of infographics in post-secondary education - **Lisa**	
Teacher influences	**Student influences**
• Different from what currently doing; teaching style conflicts • Instructor knowing how to develop infographic • Teacher resistant/hesitant to change • Resistance from teachers (general) • Perception that infographics might be childish • Teacher adoption of infographics	• Learning style/Learner Potential resistance from students • Student population, generational, cultural consideration • type considerations • Students not familiar with infographics/not knowing how to develop • Additional stressor for students
Curriculum influences	**Skill influences**
• Curriculum/program restrictions/common course/common final	• Drawing skill set/abilities • Visualization skills and abilities • Design, layout, and organization skills and abilities
Time influences	
• Takes time to learn (learning curve)	

Among the factors that might influence the use of infographics in post-secondary education, Lisa focused more on the potential for resistance from students and teachers to an infographics assignment. She indicated that it might be a result of general resistance to change or related to learner type and ability.

> I wonder if there would be, and I don't know, I don't know the answer to this, I'm just throwing it out, I don't know if there would be a resistance from students. Cause sometimes there is, just in general, with all of us, there's a resistance to new things sometimes because we're so used to doing what we do and I just wonder with, with our, culture of our students, would they be resistant to learn something like that and use it or would they not. I think maybe some of the more

artistic, creative, thinkers would really think something like that was really cool, you know, and really useful but I wonder if some, maybe the other types of learners would, would maybe see.

Lisa thought some of the potential resistance from students might be as a result of them not knowing how to develop in infographic and that an infographic assignment might be something new for them. "The only concern maybe and this is just maybe, would just maybe student's understanding of it and, cause of course it would be something new to them."

Lisa continued,

How to do it and, and what, and the process of it, you know, that their same thinking should be in that you know just be conveying what they're trying to say in that same way as they would in a paper and whether or not they might have some resistance. You know, some people, some students, or just people in general were sometimes not open to new, to new ideas, or change or, or anything like that so maybe just some resistance would maybe be, but that's going to be with anything, not just with an infograph it's going to be with anything.

Lisa thought that using an infographics assignment might contribute to elevated stress levels for some students and this might add to some resistance. She said, "Some students might view it as a stressor, others might be more open to it but I don't know, I would hope that it wouldn't." She explains further,

I mean a, a visual learner might look at that and be like alright, you know, I get to do that and not write this paper. But somebody who is more, I don't know, an English major, you know, they might be like, ugh, you know, I've got to draw a

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picture, I've got to do what? So I don't know, it may or may not be a stressor, I don't know.

Lisa continues to discuss the issue of additional stress,

But stress, if you want to get into the subject of stress, now stress is a subjective thing so you know what might stress one student out somebody else might be like, well that's no big deal, so you get into that. Some might view it as stress, some might not, I don't know.

Lisa thought that there would also be a potential for resistance coming from faculty related to using infographics in their classroom.

I think some teachers might be resistant. I think cause a lot of us get into our same old routine and we've already got our courses kind of, it would almost be like developing a new, you know, a new method, or a new way of, of teaching in a way. I think some teachers might be open to it; some may not be so maybe just whether or not they're open to, to the new ideas.

Lisa continued,

I think teachers and students both would be resistant, cause for some reason, just, and I'm a lot this way, something new sometimes might be intriguing but sometimes it might be like oh gosh, I've got to learn something else, you know, it's like a dread, but yeah, I think maybe some resistance. But if people can get past that and be open to it, and learn, you know, I think it would be.

Lisa indicated that teaching style might also influence the use of infographics.

It might depend [teacher resistance to using infographics] on the teacher's teaching style. I mean I've been talking a lot about learning styles. Every teacher

has their own teaching style too, so, whatever their comfortable with or whatever they like to do in their classes. I mean like me, I'm lecture I like lecture other teachers might be do more in class stuff – projects or group things so the teaching style might, might, I don't know.

Lisa also suggested ways that student and faculty resistance might be addressed. These suggestions are included in the detail section along with suggestions from the other participants.

Infographics uses. Lisa identified several examples of using infographics in post-secondary education. Table 43 provides a listing of the infographic uses Lisa mentioned during the interview.

Table 43

Uses for Infographics - Lisa

Infographic uses - **Lisa**
• Improve classroom experience/lecture, presenting information
• Study guide/study strategy
• Different way of communicating information
• Projects
• Critical thinking assignments
• As an alternative to existing assignment/optional assignment
• Used to assess learning

Lisa thought that they could be used to promote study, guide instruction, present material, and provide a way to improve her classes. As a memory and/or study strategy, she contributed, "I think it could be beneficial in that way, you know memory strategies, study strategies, things like that for faculty to use an infograph for their students." As a course supplement, she thought that infographics could be used to provide another way to communicate course content. Lisa suggested,

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Give them a study guide if, if I can, if they you know, or some sort of outline or

something about what to study so if they could have a visual you know of that or

how to connect you know certain concepts or things to help it, to help them learn

the material definitely for that. Maybe if something is complicated, something

that's more complex maybe to use an infograph, maybe would help simplify or

break it down.

Lisa continues,

I always provide either PowerPoints or, or study notes or an agenda, or something

that supplements the course that way they're not too busy taking a bunch of notes

and they can listen and all that so I think maybe you know. If I want to use some

sort of infographics for my for my notes, my lectures, you know, just to kind of

spruce em up [laughs] if nothing else you know, but to keep it you know, to I

guess, learning, I mean I think for me and my classes it's all about the learning,

helping them learn the material.

Lisa also thought that infographics could be used to help instructors

prepare for class and provide a way to deliver instruction. She stated, "So even for

myself you know, for review or some kind of you know, guide or maybe some

new way of even for myself to present the material.

Overall, Lisa indicated that infographics could be used in her discipline as

alternative to existing assignments.

Every class that I teach I do some sort of writing assignment or some sort of

critical thinking assignment. In [specific course Lisa teaches] I do two critical

thinking assignments. Now an infograph maybe would be great for those now that I think about that.

Infographics and learning – Lisa. Lisa refers to several concepts regarding the impact and influence of developing infographics to learning and the learning process. Table 44 provides an overview of Lisa's comments involving the learning impact of infographics.

Table 44

Infographics and Learning - Lisa

Infographics and Learning - **Lisa**	
Emphasized Concepts	**Other Concepts**
• Meets needs of different learning styles; learner needs; might not be for everybody	• Reinforces learning; retention and recall; memory/study aid
• Something different; another form of learning, new ways of learning/challenging students	• Promotes visualization skills; visually communicate understanding
• Promotes critical thought, higher-level thinking, critical analysis	• Infographics as a teaching activity (teach to learn); being able to communicate understanding to others
• Promotes in-depth understanding; perspective; improve comprehension/understanding	• Promotes information checking/vetting/research skills
	• Valuable for students to go through process; finding a way to learn
	• Useful tool
	• Open teacher minds to other ways of teaching/learning

Learning styles. Lisa mentions the influence of infographics to different learner/students types, the benefits to learning associated with infographic development, and characteristics of infographic assignments. Lisa stated,

There's all different types of learning and different learners and of course here [at the college], we have all different types of students, so I think the infograph would definitely help, well it could help all types of learners I guess, but I started to say the ones who are more visual learners, and maybe those that aren't, it might open their mind, you know to see something in a different way, maybe, but definitely with the learning, and the critical thinking and maybe some of the fundamentals I guess that we, we want them to kind of know as a result of having an intro class.

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Lisa added, "I keep talking about the learning styles but I, I think the, the learning styles definitely fit with all of this, I mean, because everybody is different and everybody learns differently."

She continued,

I like to teach though in a way that meets all needs of the students and all different types of learners so this would be you know, a supplement to that, as another way, like I said for maybe some of the people who are more visual, you know, the more creative, artistic people, they might appreciate an assignment like this - infograph.

Different approach. Lisa talked about how the infographic development experience influenced her thoughts related to how the infographic might be used as a way to influence learning. She said, "It's new and it's a different way of learning and seeing something in a new, maybe the same thing, in a new, different way…" She repeatedly describes the aspect of the experience as being something that she has not seen before stating "It's [training on developing infographics] influenced my thoughts because it's opened my mind to something new and different." She added, "I mean, it gets us thinking, in other ways…" She adds later, "I think it opens our minds to other ways of [pause] teaching and student learning. Lisa also mentions that infographics provide a way for students to communicate their learning.

And another way of communicating what they're, what they're learning in class. I mean, like I said while ago, it's the same thing as whether they're writing a speech, or writing a paper, or if they're doing an art project in [art teacher's] class or whatever, I mean. It's all communication in college and that's what we want

people to do, is to be able to be effective, you know, communicators [laughs]. Just another way of learning, I mean.

Critical thinking. At one point in the interview, Lisa talks about how developing an infographic would develop critical thinking skills – skills she believes to be an outcome of post-secondary education. She said, "I don't know I think it might, it might help with critical thinking. I'm all about critical thinking in my classes, I think college should change our thinking, if it doesn't what's the point in going [laughs]."

Lisa reflected on how she thought the infographic influenced student learning and talked about how students might experience an infographic assignment. Lisa thought that critical thinking was a major learning benefits associated with infographics stating "Critical thinking is a big one [learning outcome] for me." Lisa continued,

It [infographic] might give them a better way of, you know, analyzing, you know analysis of stuff and analyzing it and maybe evaluating, maybe some of that higher-level thinking that we kind of strive for, but rarely reach [laughs].

Teaching style. At several points throughout the interview Lisa mentions that her teaching style is more traditional and that this type of assignment has influenced her thoughts about how she might approach teaching.

I'm kind of old school a little, so for me to consider putting something like this, you know, on my critical thinking, of course that's influenced me, you know, to something new, and made me measuring learning, you know differently too.

A process. She also touched on the processes students might need to go through in order to develop the infographic and how that process would influence learning saying, "It's just like anything else, you're going to have to research it, and look it up, or figure it

out, or learn about it." Lisa also describes a concept mentioned by some of the other

participants regarding characteristics of the infographic assignment and how it influences

learning. She talks about how going through the process of teaching helps to improve

understanding. Lisa stated, "I mean I've always heard that you know you've learned

something when you can explain it to someone else" Lisa added "But it's true, when you

can explain something clearly to someone else that means, that you've learned it too, and

I think just being a teacher, I think we learn constantly."

Teaching infographics – Lisa. The teaching of infographics was a theme that

Lisa spent the least amount of time discussing. Concepts that Lisa mentioned involving

the teaching of infographics are included in Table 45.

Table 45

Teaching Infographics - Lisa

Teaching Infographics - **Lisa**	
Preparing to teach an infographics lesson (thoughts) • Teacher should understand how to develop an infographic • Willing to be creative • Being open-minded; open to new things **Planning and preparation** • Provide time for practice **Instructional practices** • Provide examples/samples • Use groups • Use a process, step-by-step approach, model • Start small, simple, slow • Address concerns students may have with sketching/drawing	**Instructional practices (continued)** • Use technology/internet/images/clip art; other media • Provide clear instructions • Bring in a trainer to assist **Learner support** • Provide tools, resources, cool stuff • Provide students with design template, design options • Be available for students • Help students to develop a topic

Lisa describes factors influencing the teaching of infographics and provides

suggestions on how she might teach infographics to students. These teaching suggestions

are touched on in this section but detailed in the sections that follow. Lisa commented

that she thought that teachers should first learn how to develop an infographic She said,

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"I mean I think they first need to know what it is you know what is an infograph, how to develop one…" She describes the skill set and characteristics believed to be necessary to teach someone how to develop an infographic.

I don't think that you would necessarily have to be an art teacher to use this, but definitely as a teacher, those other, you know those characteristics of being you know, being open minded, willing, you know, willing to, you know, get in touch with your creative side a little bit and being able to do the visual part, I mean all that. Yeah I think so, it mirrors it.

Lisa also thought that a teacher would need to be clear in communicating and explaining infographics and be willing to assist students as they develop their infographics. Lisa stated,

Well for one, communication again, being available, availability, willing to help them, you know, maybe sit down with them one on one, see what they've got, guide them, see, you know, whether they're in the right direction or whether they're not, put them on the right path.

Lisa continued,

So explanation, explain things to them, be clear, I like for everything to be clear in my class, and explain it and really break it down so that everybody's, you know, try to come down, you know.

Lisa provided suggestions on how she thought infographics might be taught. These include using a program or process, providing instructional assistance, providing examples, and using groups.

Using a program/process. Lisa shared that using a program and process to develop infographics might be helpful.

> I liked the way you set up the training with us. You know, you had a packet and each page, you know, how you went through those letters, how each letter represented, I think that helps, it helps break it down, it takes it step by step in in learning it and then it all comes together for you, you know at the end. So yeah I think something similar to that would be, yeah like that, exactly like it or similar to.

Instructional assistance. Lisa commented that she thought instructors should also help students develop topics, assist with visualizing ideas, and encourage their thinking.

> I could maybe help them come up with their topics. I could help them try to visualize it, now I probably couldn't [laughs] help them with the artistic part. I could probably encourage their thinking a little bit, you know, get them at least thinking about it.

Provide examples. Lisa commented several times about how providing examples of infographics was helpful and she indicated that she would recommend using examples when teaching someone to develop an infographic. She stated, "Yeah, it helped me, I mean, and as a teacher and as a student both, I do better with examples." Lisa went on to say, "I think the examples helped, it helps with that learning process."

Using groups. The use of groups was mentioned by Lisa. She thought that group work might be better for some more than others. It should be mentioned that groups were used during the training that Lisa received as part of this study.

I enjoyed working in a group in your training though. So I think for this type of

training, maybe the group, it works, even for maybe people that might be more,

you know, more individualistic and not so much dependent in a group or

whatever, but some students like group projects, others don't.

Assessing with infographics – Lisa. Table 46 provides an overview of Lisa's

comments regarding infographics and assessment.

Table 46

Assessing with Infographics - Lisa

Assessing with Infographics - **Lisa**

Thoughts about assessing with infographics

- Quicker, more efficient form of assessment; easier to grade
- Good way to evaluate learning/demonstrate understanding
- New way of learning/measuring learning, something different
- New way of communicating learning
- Balances the grade
- Use a rubric

Factors influencing assessment

- Grading challenges/considerations
- New way of assessing, unfamiliar to students
- Common assessment practices within discipline (common final)
- Graphics quality has potential to influence grade
- Graphics quality might be subject/course dependent

Suggestions for assessment criteria

- Depth of understanding displayed, key concepts clearly communicated
- Content independent of artwork/graphics quality

Other assessment suggestions

- None provided

Regarding assessment Lisa thought that infographics could be used to assess

learning stating, "I think you could. I could assess it from that." She also describes some

benefits of using an infographic to assess student learning. She also discusses potential

benefits and challenges associated with using infographics for assessment. Benefits for

using an infographic to assess student learning include providing students with alternative

means to demonstrate learning, and an alternative for different learning styles. Lisa shared,

> It helps balance the grade and so something like this for people that are really visual and artistic, it might, you know, it, if that's their strength, you know, that might just help balance out their grade too if they weren't good at writing maybe they're better at this so just, hitting, you know, getting you know, just meeting everybody's needs, you know, using it as an option to meet everybody's…learning style.

Lisa commented that an infographic might make the process of grading more efficient stating,

> Maybe an infograph, now that I'm sitting here thinking that might even be a little easier to, to grade because, it's all in one place and you don't have to [pause] read through it, and try to make sense of it in that way and it's like saying the same thing just in a different way. So, I don't know, I think it might be simpler.

Lisa added, "I think you could probably grade an infograph maybe quicker." Lisa reflected on an assignment that she thought similar to the infographic assignment.

> I have had students in the past that [use pictures in an assignment], and I guess it would be an infograph kind of, but instead of writing it, they'll do a picture, and put all their ascribes, cause I've put it on the board that way before and it helps, and now that I'm thinking back I haven't had any students do that for a long time but I've had some that have been really great and really creative but they'll do that as a picture, not in written form but thinking about grading them though with your question. It is easier to grade cause you look at the picture.

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Lisa also describes challenges associated with using an infographic as way to assess learning. She describes challenges associated with the subjective nature of the infographic being similar to that involved with grading a writing assignment.

I struggle grading just a regular paper because it's, it's so subjective, it is, I mean, like I will do multiple choice tests in class when I test them but you know that's multiple choice is, you know, it's objective you know but when they do their writing to me it's so subjective… I look for those critical thinking skills and mostly their thought process is what I'm really looking for and sometimes that's hard to measure it's hard to grade.

She expands by saying,

When I do critical thinking, that's what I'm looking for their thinking, so on an infograph I would probably assess it the same way I would with that. I would probably look at their content that's in there I mean it wouldn't have to be the most beautiful picture or anything.

Lisa discussed how the graphics used in the visualization might potentially influence the grading of an infographic. She thought that she would grade an infographic the same as other assignments.

You can't cancel out the fact that, you know, something real fancy would probably, look better right off the bat, be like wow, but I don't know, as a teacher, especially if I was first introducing this and it wasn't required, and it didn't have to be fancy, that's, cause that's kind of how I am with their papers.

She expanded on that thought,

> Cause they're all forms of communication and they're all ways of learning so, and, you know, but no matter if they do a paper, or if they do a speech, or even if they do an infograph, I would grade them, I would have, you know, I would grade them all the same. You know I look at that thinking and you know grade them all the same I would.

Lisa mentioned that she thought the grading the graphics quality on an infographic might be discipline or subject specific.

> It might depend on the subject too. I mean like what I teach, I probably wouldn't let it influence my grading if it, you know, if it wasn't required but now if I was teaching something like [different subject area] or something like that, to where it, you know, had to be this polished, you know, thing, that might be different so I don't know, the subject matter might.

She continued revealing how she would approach grading an infographic.

> I would be fair in the grading, I probably wouldn't grade them any differently, especially if it wasn't required to be and that's what I do even when I'm grading a paper or anything, I look for the content mostly, their thinking, I look at that more.

Lisa also mentioned that the use of a common course or common final might influence and impact the use of infographics in post-secondary education. She indicated that in her academic division, some classes utilize a common approach for assessment. Lisa thought that if someone wanted to use something like an infographic for assessment it might not be possible in that environment.

Where SACS [regional accreditation association] requires all the student learning

outcomes and all that stuff, you know we've had to come up with ways as a

department, and so that's why we are using our common, that uniform, that

common final, for every one of us to assess our student learning outcomes as a

way to meet that, so it's like I feel like as long as we're doing a collaborative

something, I don't know if people would be on board with an infograph, you

know, since we have to come up with, with that, but, but just in general though,

and for, you know, individual teachers, I think maybe it might could you know,

but, for what I teach, we have to, we're doing what we're doing, it's not solely my

decision.

Developing infographics – Lisa. In this theme, Lisa focuses on several key

concepts including challenges associated with visualizing ideas, drawing issues, and the

perceived influences of creativity. A listing of Lisa's comments regarding the

development of infographics is included in Table 47.

Table 47

Developing Infographics - Lisa

Developing infographics - **Lisa**

Skills required
- Creativity
- Ability to visualize and graphically represent concepts
- Basic art skills/abilities
- Following steps to develop an infographic
- Selecting/Coming up with an infographic topic
- Open mind

Other considerations
- Drawing over technology tools
  - Reason – lesson the learning curve

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Visualizing ideas. Lisa's described that she thought based on her experience developing an infographic that being able to visualize an idea would be a factor influencing the development of an infographic.

> If you're not a visual person, that can sometimes be a little tricky, I think, so just trying to visualize it, I think, is a process in itself, using that, you know, trying to come up with a mental representation of what you're trying to say.

Lisa added,

> I'm not an artist, but anyway, so for me, but I think if you're not an artistic, well artistic that can be an odd topic really, if you're not good at drawing or not good at that type of, [pause] but then again if you can visualize it in your mind though sometimes just getting it from there on paper is the hardest part sometimes.

Lisa reflected and described her experience of struggling to visualizing the concept she developed for her infographic stating, "I'm thinking, okay how can I do that in a clear, concise way on one sheet of paper, this idea so, easy to follow, just visualizing the concepts…" She adds, "Yeah, just putting that from your mind onto paper [laughs] I mean that's hard for me anyway" Lisa also shared that she understood that the visualization part of developing an infographic was only part of the overall process.

> You can picture it in your mind but then if you're not artistic, or if you feel like you're not artistic, you know just putting it from there on the paper, I think, but like you just pointed out, that is part of the process of, of doing it, and I think a lot of times in learning it starts with an idea and if you can visualize it sometimes that's the primary thing like you said, the other part's secondary.

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Drawing. Lisa commented throughout the interview about her issues that she was having related to the actual drawing/sketching of the infographic. She describes her experience related to this factor of developing an infographic. Lisa said, "I'm not good at drawing that was the part that I would probably have the most difficulty with if I was to do this in real life you know." She adds "Having to feel like, you know, you need to draw a picture but you don't know how you know [laughs], you feel like you're not good at that."

She also thought that students might have some of the same issues with the drawing part that she was having.

The drawing too, some students might automatically be like, oh, like me, you

know, they might say, oh gosh I don't know how to do this I'm not an artist, I'm

not a, I don't know how to draw, I mean.

Lisa continued,

I think so if they're not artistic, but now, I think the people that are very creative

and are that can draw and take art and are visual learners and, I think it might be easier

for them. And maybe other learners not so much

Creativity. Lisa perceived and shared that she thought there would need to be a certain amount of creativity necessary to develop an infographic. "I think creative, certain amount of creativity, some sort of artistic ability. Cause I do think the artistic people are more the visual learners. I think that visual part definitely has to be there for this." She adds, "I mean some people are very creative some aren't."

Drawing versus technology tools. I asked Lisa what she thought about using a drawing approach compared to using technology tools. Lisa commented,

I liked the sketch-based myself, of course that's the only approach that I know, but I liked the sketch-based. Like a said a while ago, it takes it step by step it lets you get the feel for it, you know, and learn it first.

Lisa added that utilizing drawing for developing infographics would enable students to get familiar with the concept of infographics. She said,

I think that's a good approach [drawing infographics]…I liked that approach…Yeah, right, I think so, I think this could be used first to kind of like I said a while ago, get the feel of it and learn about it and learn what to do and then if you wanted to make it, you know, real fancy, you could build your, work your way up to that.

Participant Viewpoint - Natalie

Natalie has taught in post-secondary education for 13 years. Natalie also has several years of experience teaching in the public school system. She currently teaches in the Business and Professional Services discipline. Natalie has a Master's Degree in her discipline. She has no prior experience with infographics but has utilized concept mapping, another form of information visualization, in her classes.

During the infographic training, Natalie developed an infographic describing the concept of brain development. Figure 33 displays Natalie's infographic. Natalie wanted to practice on a concept that she utilizes in her classes. The purpose of Natalie's infographic was to provide students with an overview of brain development. She wanted this infographic to be something that she could use to help students learn the concept.
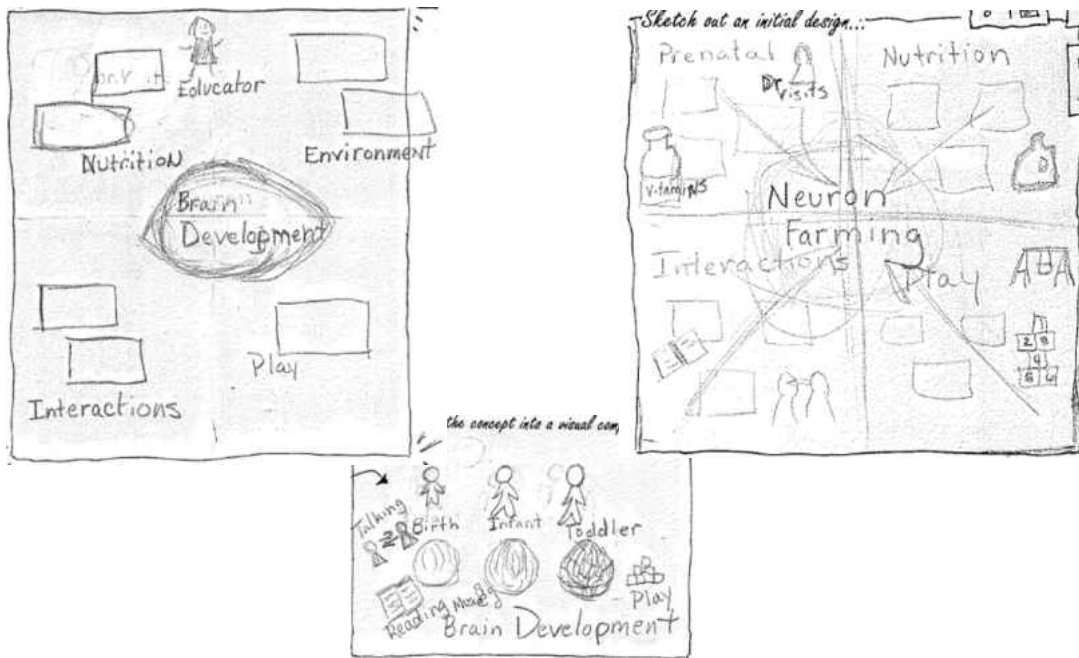
Figure 33 – Natalie's infographics

In this section, Natalie's experience with infographics is explored. Figures 34 and 35 graphically illustrate how Natalie perceived her infographic development experience.
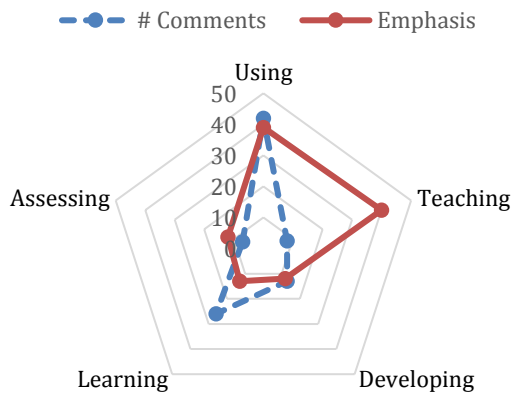
Figure 34. Natalie's comments and emphasis by theme – radar chart. The dotted line in the figure represent comments made by Natalie related to the themes of this study. The solid line represents areas that Natalie emphasized.
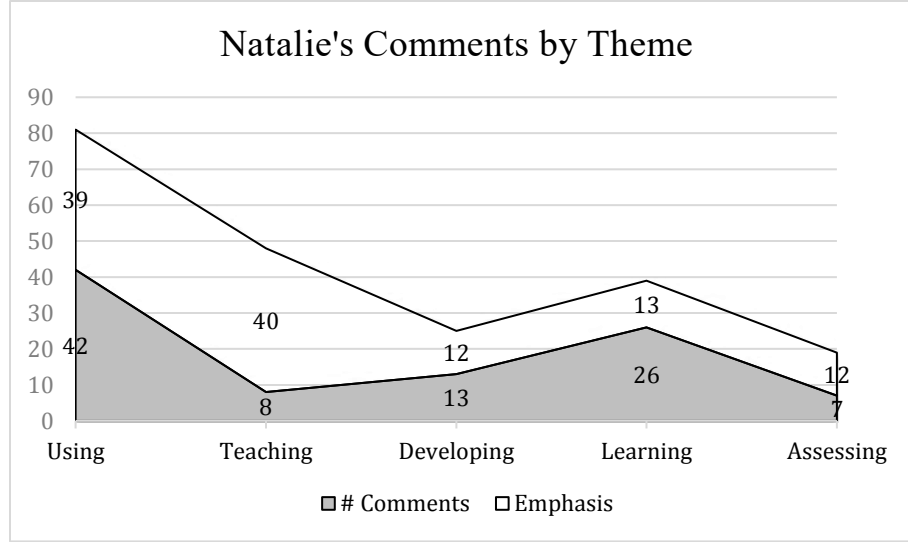
Figure 35. Natalie's comments and emphasis by theme – area chart. The area at the bottom of the graph displays comments made by Natalie related to each of the study themes. The area at the top of the figure provides additional comments made by Natalie emphasizing comments and themes.

Based on Natalie's comments during the interview and after the coding process was completed I classified Natalie's experience as U-T-L-D-A. Table 48 provides Natalie's comments and emphasis areas about the infographic development experience.

Table 48

Natalie's Comments and Emphasis by Theme

	Theme	# Comments	Emphasis	Total
U	Using Infographics	42	39	81
T	Teaching Infographics	8	40	48
L	Infographics and Learning	26	13	39
D	Developing Infographics	13	12	25
A	Assessing with Infographics	7	12	19

Natalie's experience primarily focused on the themes *Using Infographics* (U) and *Teaching Infographics* (T). She also discussed concepts associated with the other three themes in the following order of emphasis: *Infographics and Learning* (L), *Developing Infographics* (D), *and Assessing with Infographics* (A). As described previously, this organization by themes is resultant of an analysis of the codes developed from the interview transcripts and then by emphasis provided by the participant as reflected in the transcripts. The following overview of Natalie's experience is arranged based on this organization by theme and is intended to provide insight into the major concepts that Natalie shared. Each section contains a detailed listing of the concepts she mentioned along with a more detailed description of areas that she emphasized.

Using infographics – Natalie. In this theme, Natalie emphasized that infographics provided an alternative way to teach student and a new way to reach students, and a way to improve the class experience. She also provides examples of why infographics might be used, potential uses for infographics, some key factors that might influence infographic usage in post-secondary education, and student factors that she believes might have the potential to influence usage of infographics.

Natalie thought that infographics might be a way to improve her course. She stated, "I don't really have anything close to this, with this much detail, you know, in my courses. So I think it would be, you know, a cutting-edge way to make my classes better." Natalie thought that infographics could be used in post-secondary education and describes her thoughts as follows.

Well I think, it's, I, yes, I think everybody should, I mean, I think if they're willing to learn something completely different, I don't think it's for everybody

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but I think that about every discipline could use this, I don't think that there would

be a discipline that couldn't use it, they may use it in a different way or maybe

even use it in like their syllabus and may not incorporate it into their classwork,

but I think every discipline could use this. It's just getting them to kind of, not be

afraid of, you know, trying something new, and, and maybe not being successful

the first time you know [laughs].

Natalie suggests a way to introduce infographics to students. She said,

You know you may just try to introduce it by using your syllabus, do something

that's not an assignment for them but expose them to it first before you actually

get them into an assignment or use it in your lecture instead of a PowerPoint, and

then bring it in, you know, because, then they'll be like, oh yeah, that's what

you're, ok, I saw, I've seen that, you know, I think as a teacher if we can kind of

bring it in slowly for us, it'd show that we're using it, you'll get buy-in from

them.

Table 49

Uses for Infographics - Natalie

Infographic uses - **Natalie**
- Student notetaking
- Way for teacher to present/communicate information
- Used as an alternative to existing assignment/alternative assessment
- Resume
- Portfolio
- Syllabus
- Student recruitment
- Enhance the reading experience

Natalie describes several uses for infographics in post-secondary education. These uses for infographics are included in Table 49. Among the uses that she emphasized during our interview were various notetaking applications, as a way to present information to students, and using infographics as an alternative form of assessment.

Student notetaking. Natalie discussed the use of infographics as a way to take notes and to use the notes as an assessment of learning.

> The first thing that jumped into my mind was is, when you, I try to get them to use their textbooks some, for one thing it is a great expense and there is good information in there. But one thing that jumped into my head when we were doing the training was instead of having them, just testing them over that material, cause I always give like quizzes, things throughout just to kind of keep them on track, is to have them take notes like this and then present them to me in a blog area or somewhere and kind of talk about what they took from it and so that was my first initial thought was to kind of, that way we can kind of, and then also, I always have lecture along with my textbooks so just have them take notes and then that way I can see if they're getting it. Help me know, especially with how I teach online, so that's the first thought that came to my mind was to kind of make the reading experience more meaningful for them.

> Natalie continued to talk about the note taking applications explaining that she didn't think that student understood how to take notes. She commented, "I think the idea about note taking is really important because I don't think a lot of kids know how to take notes."

Communicating information to students. Another application of infographics that was emphasized by Natalie was the use of infographics as an alternative way to communicate information to students. She describes infographics as, "Another way for me to learn how to teach my students that's what I saw it as, and also maybe another way for me to present information to them."

As an alternative assessment. She also describes how she might use infographics as assessment. In this example use, she talked about how she could try out the concept as an alternative to an existing assignment and approach the process a differently.

> Thought I might even try to incorporate it into a survey [quiz] to see how the students are attracted to it and then maybe take one or two of my lectures and try to incorporate that and so, and then eventually once I feel like I'm pretty good, try to get to where the student could maybe just take an idea and instead of writing a paper like you were saying, they could develop an infomatic to explain it to me. Kind of get away from the PowerPoints, you know, just a different way of learning.

She also describes an application involving her course syllabus and using the infographic as an assessment.

> What I'm going to do is I'm going to take everything, I don't call it a quiz, I call it a survey, and I'm going to take everything on the survey and create an infomatics about it and put that in with the syllabus and try to do a verbal thing so I go through it with them.

Resumes and portfolios. Natalie also thought that infographics could be used for resumes and portfolios. She offered, "I can see me using this like where you talked about for a resume." She added,

> I may do it with them, they have to do a portfolio on a child, and I was
>
> thinking it might be a different way then, have a portfolio, because they
>
> have to incorporate anecdotal notes, they have to incorporate pictures, and
>
> I was just thinking how that could be a nice presentation.

> Natalie thought that she would prefer to introduce infographics in her upper level courses, "I thought I would do it with one of my upper-level classes not my 101 or 102 cause those students, some of them it's their first opportunity to be in a blackboard class and that's enough stress."

Factors influencing infographic use –Natalie. Natalie shared several factors with me that she believed would influence the use of infographics in post-secondary education. These factors are provided in Table 50. Natalie spends more time discussing the teacher-related and student-related factors influencing infographic use. All of the concepts she mentioned are included for reference.

Table 50

Factors Influencing Infographic Use - Natalie

Factors influencing use of infographics in post-secondary education - **Natalie**	
Teacher influences	**Time influences**
• Culture of post-secondary education • Teacher resistant/hesitant to change • Instructor knowing how to follow steps to develop infographic • Moving away from lecture • Tend to teach the way we want to learn • Challenge to develop a lesson in way that makes sense to student	• Takes time to learn (learning curve) • Time and effort required **Student influences** • New generations of students • Learning style/learning type
Curriculum influences	**Skill influences**
• None provided	• Drawing skill set/abilities • Visualization skills and abilities

The factors that Natalie emphasized during our interview include a resistant culture of higher education, a faculty resistant to change, and student-related influences. Among the concepts mentioned involving influencing factors, issues focusing on a resistant post-secondary culture and faculty received the most attention from Natalie.

Culture of post-secondary education. Natalie suggests that expectations from students may be changing and in order to meet these changing demands, higher education needs to change. She thought that we are experiencing a changing culture both from a standpoint of post-secondary education and student expectations.

> Well, I think that our culture is changing and I don't think it's just, I know with
>
> all the schools are facing enrollment problems and you know our students the way
>
> they want classes delivered is changing…" Natalie added, "It needs to change
>
> [culture of higher education], I think it does…" Natalie also reflected back on the
>
> infographic development experience offering, "I think this is a real way to change
>
> the culture of what we expect from students." She also commented on how the

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resistance to change in post-secondary education may be having an effect on the success of our students.

Natalie continued,

I think we just have, I try not to ever be afraid to say, you know, maybe my way is not the best way, maybe I need to rethink this, and you know like I, I have one exam and it's the final all my other work is like projects things because I saw the trend in the professional standards boards and what they're going to and so I just went with it so I think if we could just get people to see that the long-term can do, how we can, you know, change, I think we might have some students who typically may not have been successful, they might be successful in the college experience.

In the following excerpt, Natalie continues to describe her perception of the post-secondary educational culture.

I think that we need to get away from this where, where they're not afraid to come to us and I think that some, I think some people kind of hide behind the, the intellect, and kind of hide, I mean this, I'm getting way too deep, I know, but I just think sometimes instructors when they are afraid of change they kind of go well we can't do that, we've never done it that way, it will never work. Well, I think that that attitude's got to go away, it's just got to go away.

Resistance from teachers/resistance to change. Natalie describes a potential resistance from teachers to change the way they teach. She told me, "I think the most, probably the disadvantages will be with the faculty, the teachers, because I think with teachers it is hard to change." She went on to say, "I think just change for some people is

hard. That's, that's going to be the, but you know, you can't get everybody to buy-in to everything…" This recurring thought about teachers being resistant to change is highlighted in the following comments. In this excerpt, Natalie describes how this resistance may be resultant from several factors. She again touches on the culture of post-secondary education.

> I think there's some people that will never want to do it, you know. They are at a point in their life or their career that no, I can't do this you know but then I think there are people that you know, once you could just like get them started slowly or you know like, they may catch on, but I think that's where and then administration because they are so focused, like in the public schools, about testing and then now how in the college sector we are becoming so data driven. You know but this, to me, is data. So you know, it just, you know, the way you introduce it, but I think that it's we have to change our culture, we just have to. I mean that is the only way.

Although many of Natalie's comments in this theme focus on the culture of post-secondary education and the teacher's resistance to change, she offers another possible influencing factor. She mentioned that this resistance to change might be because of fears associated with changing the way lessons are taught.

> I think, yeah, I think you just got to not be afraid to make mistakes and to, yeah I think that's why a lot of times we are afraid to teach away from lecture because it's kind of hard to screw it up, I mean, you know what I mean.

Natalie commented that teachers might be disconnected from what the students might be going through when learning something new.

You know your field but your students coming in do not, so you need to meet them there. And I think that sometimes I think when we test the instructors and they have to change their methods, it makes them remember that a little bit, out of their comfort zone. I mean, I think that we need to be shook up a little bit.

Student influences. Natalie spent a considerable amount of time talking about the influences that our student population might impart on the decision whether or not to use infographics. These include a new generation of learners and expectations that these new learners bring with them to post-secondary education.

New generation of learners and learning style considerations. Natalie shared with me an experience her daughter had in high school. She described a project that the students were assigned which required a great degree of creativity and freedom in the completion of the assignment. The assignment she referenced was much different than a traditional assignment and really challenged the students. She describes the newer generation of learners as not being afraid to take on challenging assignments that enable them to use their creativity and their knowledge about technology to achieve learning goals in ways that are different to traditional methods.

Well, I think how you want to do it through the like K-12, how you are, that's your ultimate goal I think that is exactly what needs to be happening just because I have children in those age groups now and like for instance, [someone Natalie knew] who is a senior, she had [specific] class and instead of a sit-down paper final, they put them in teams and they had to develop a video – a music video and they couldn't just like, it was, and she told me the time it took but what was crazy was, is that they used their phones and did the whole freakin thing I mean they

even like incorporated different songs, cut parts out did editing and things and I asked her about it when she showed it I said do you think you learned more by doing this than a final where you do a fill in the dot. Oh, she said, this took forever and she goes can it comparison we worked two days solid on this and she said what she liked was is that they kind of had the run of the school, they did one where she was in a locker and someone walked by and opened it and she I mean it was liked they really put some creativity to it. So I think that if you introduce this to high school kids or even if they start young with it and kind of work up to it and I think it would be perfect.

Natalie also noted the differences between different generations of learners.

You made me feel really comfortable about it because like you were showing us different ways to do it where you know, if it's just a stick person who cares, you know. And also, like I said in the training I think about my [someone Natalie knew] the way they'll sit and text me and joke around with emojis they don't think anything about that stuff. I mean everything is an emoji to them, so I think that the population coming up, I don't think they worry about it anymore, because there is so many, they know the devices to get to do that stuff, they know how to find it, and that's where I have got, that's one thing with my older students, my non-traditional, cause I will get questions like I don't know.

Other restrictions/constrictions. Natalie related to me how she thinks that in the public schools, teachers are constrained within their courses and that these restrictions might limit the learning potential.

The teachers aren't allowed to kind of veer off the path much, you know,

it's kind of planned out for them, and so there is a lot of regurgitation

going on, you know, take it in, get it back out, you know, so I think this

would be such a great way for kids to learn.

Teaching infographics – Natalie. Of all the concepts mentioned during the

interview, Natalie offered more teaching comments than the other participants. Table 51

provides an overview of Natalie's thoughts about teaching infographics.

Table 51

Teaching Infographics - Natalie

Teaching Infographics - **Natalie**	
Preparing to teach an infographics lesson (thoughts)	**Instructional practices (continued)**
• Teacher should understand how to develop an infographic	• Address concerns students may have with drawing/sketching
• Realize that it may not go well the first time	• Explain role of drawing/sketching; not about graphics
• Commit to planning and developing infographic components; commit to use	• Delay judgement, don't expect perfection, permission to screw up
• Develop a library/repository of infographic samples	• Use technology/internet/images/clip art; other media
• Be able to adapt to new way of teaching; modify teaching approach	• Allow for revision, flexibility, freedom to create
• Be open-minded, open to new things	• Make it fun
• Don't be afraid to make mistakes	• How it is introduced
• Pick the right course/topic	• Be up front about time commitment
	• Use labels to offset drawing limitations, written portion to explain
Planning and preparation	• Challenge students
• Provide time for practice	• Delay sketching until later
• Need time to learn before teaching someone else	• Use a common/familiar topic
• Time for learning/dealing with the learning curve	• Establish a non-threatening environment
• Don't move too quickly; spend some time	
• Going to take some time, accept that it is not going to be easy at first	**Learner support**
	• Provide tools, resources, cool stuff
	• Don't just introduce without support
Instructional practices	• Provide students with design template, design options
• Teacher uses infographics in class	• Be available for students
• Provide examples/samples	• Teacher participation, involvement, support
• Use groups	• Develop training videos, webcasts
• Use a process, model, approach	• Be patient and supportive
• Start small, simple, slow	
• Demonstrate, work along with students	**Training environment**
	• Training packet, development model

Although Natalie mentioned numerous teaching suggestions, she did not emphasize or elaborate on the teaching aspects as much as she did the other themes. Of all the concepts mentioned, she focused on the importance of being able to develop and understanding the process of developing an infographic herself before introducing the concept to students. Natalie thought that if she was going to use infographics in class, she needed to be able to develop an infographic, "If I'm going to ask them to do it, I need to do it. At some level, I mean I think so." She added, "Cause for me, to introduce something in a classroom, I need to see, I mean after going through I thought, this is workable, this is doable, because I actually had to do it."

Similarly, she thought that teachers needed some time to work with infographics before asking students to develop one.

> Well, you as a teacher got to understand, you've got to have the concepts broke down for them already and you got to make sure and I think as a teacher you need to kind of go through it yourself before you teach it, to make sure that it is broke down enough…We don't want them to be the test subjects, we should be the test subjects to maybe see if it is doable and how we might want to tweak it.

To elaborate further, Natalie thought it important to mention that teachers needed to make sure that the infographic assignment was understandable to students. As she stated previously, she thought this would require familiarity with the infographic form.

> I think what it is is that you have to think about where your kids are and not try to go over their head and that's the hard part I think is to make it simplify it, let the teacher simplify it to the point where they can feel success at it and then they will

continue to do it. Because I think if we make it where it doesn't make a lot of

sense to them they're not going to do it.

Natalie continues on a similar line of thought,

I think just trying to develop it in a way that makes sense to you, but it's the

students can learn it and it makes sense, that's gonna be the hard part. And I think

as an instructor we've got to be ready for the questions.

She also thought that it might make a difference if the teacher utilized infographics in

other areas of the course, "Yeah, not just make it one assignment, show them that you are

actually going to use this technique too, and that, they'll think oh, ok, yeah, she has put

some time into that." She thought providing examples would also be beneficial, "I think

if you provide examples to help them that will help them visualize."

Infographics and learning – Natalie. Natalie was influenced by the learning

potential associated with infographics. Table 52 provides an overview of Natalie's

thoughts and insights related to the learning outcomes associated with infographics.

Much of her emphasis during the interview involved her descriptions of how an

infographics assignment could influence learning. She highlighted the ability of the

infographic to promote critical thinking; as a way to 'challenge students to think', as a

way to improve the classroom, and how the infographic might meet needs of different

learners.

Table 52

Infographics and Learning - Natalie

Infographics and Learning - **Natalie**	
Emphasized Concepts	**Other Concepts**
• Meets needs of different learning styles; learner needs; might not be for everybody • Something different; another form of learning, new ways of learning/challenging students • Stimulates engagement; encourages attention; students connect with this more • Fosters creativity and imagination • Great way to learn, helpful • Way to make classes better	• Promotes critical thought, higher-level thinking, critical analysis • Encourages thought, deeper thought; rethinking • Promotes in-depth understanding; perspective • Valuable for students to go through process; finding a way to learn • Fun factor • Offsets limited reading skills • Encourages flexibility in learning

Critical thinking. Natalie thought that an infographic assignment primarily promoted critical thought hinting that an infographic required a different level of learning. "First and foremost, critical thinking. Because you have to be, you know, you are not just taking in data and putting that fact down on a multiple choice thing." Natalie thought that the infographic could provide another avenue to deliver instruction and provide a way to challenge students to think more about the subject being learned describing infographics as "A different way to learn." She elaborated; mentioning that she thought the infographic required a different level of thinking.

> It's just another way for us to introduce content and then to also receive content from students, something different to kind of challenge, to just to make them have to think a little deeper, that's what I like cause you can't just kind of throw this around.

Way to improve classroom. Natalie thought that infographics would give her a way to improve her classroom. She describes using infographics as a way to improve the lecture, as a way to capture the attention of students, and as a way to make the classroom experience more meaningful.

Students don't want to sit in a lecture for more or listen for what, eight or nine minutes, you know, but if you made notetaking kind of fun for them, where you know, almost make it where at the end then you review and go back over where they share their infomatics they are going to pay attention [laughs]. They are going to pay attention. I mean I can even see like, giving them one of these [SKETCH worksheet] blank, just this, and then do your lecture and just say, I want you to just, you know, follow me along and see where it takes you and then go back and what a way for them to teach it. So, I think it is a great opportunity, cause we have to think about that, about the students that are coming up, their attention, they are different.

She describes how infographics might improve the learning experience for students, stating, "This might be something to try and go to something different for them to see." She also talked about how infographics might make the lecture more meaningful and interesting.

I would be able to bring myself more into the lecture, you know, because they like stories and things like that. So, I could see like drawing pictures to kind of go around something, you know, it's like you know, they want all the, I think that's why you know, in the technical area we do a good job of teaching because we have that experience as teachers in our, in the workforce so we can bring that and say, this is why you have to do this, this is what I experienced. So some way to make that come alive.

Natalie also describes how she thinks that an infographic assignment should be 'fun' and 'relatable' for students. She said, "Oh, I think it would be great. I do…" adding

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"I think if you could make it where it's, like how you did the training, it was fun, it was fun for me, so I want to make it fun for my students so, I think you are on the right path."

She described again [Natalie's aquaintence's] experience in high school with an assignment that required an alternative approach to learning that was successful because the instructor structured the assignment in a way that the students could relate to. Natalie was making connections between the assignments that her [Natalie's acquaintance] had in high school with the infographics assignment that she experienced. She said that it was that type of assignment that was needed.

I think if you make it relatable and make it something they enjoy like with my [Natalie's acquaintence's] music teacher how you know they all love music, they all have iTunes accounts, I mean, he was smart, he didn't have to bring any tools to the table, they brought them all. I mean, and the way they edit stuff and things now it's crazy but you know, I think there is a real need for it.

Learning how to be creative and flexible. Natalie also thought that developing infographics would help students meet the needs in her field of study. She talked about the need for her students to be creative and flexible. Natalie explained that she thinks employers are looking for creativity, "See I want them to try and be a little more creative because I think that's what employers are looking for now." She also mentioned that in her field, students need to be able to adapt and be flexible, "I try to get them to understand that we have to be flexible and we may have to learn a whole new skill so this [infographic] would be a great way to do this

Learning types. Natalie thought that the infographic assignment would benefit different types of learners. She said,

I think this [infographic assignment] speaks to different types of learners so you

are going to meet the different types of learners even if they are just an auditory

learner, you know, they are going to get it, because it will allow them to put their

thoughts down.

She indicated that although infographics might meet the needs of different

learners, there might be some learners that would benefit from this style of assignment

better than others. "There's some students that this will come so naturally to them they

can just pull it off [snaps fingers] so it will come down to the type of learner they are."

Natalie explained that students in her program tended to be visual learners and

that her students might like this type of assignment.

I think my students would love this. Just because my students are typically

more visual learners and they are doers. And so I think that if I could, I get

comfortable with it and then get it to where it's set where they can kind of

incorporate it, I think they would like it, I do. I think they would like it.

Developing infographics – Natalie. Natalie emphasizes several concepts in this

theme. Her comments about the theme of developing infographics are included in Table

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Table 53

Developing Infographics - Natalie

Developing infographics - **Natalie**
Skills required
• Requires developer to think
• Basic art skills/abilities
• Understanding of content
• Ability to visualize and graphically represent concepts
• Following steps to develop an infographic
• Coming up with an infographic topic
• Not afraid to make mistakes
Other considerations
• Drawing over technology tools
○ Reason – lack of access to technology
○ Reason – struggles using technology; time for practice
○ Reason – teacher more secure with low tech

These concepts included the 'process' of development, the thought required to develop an infographic, the understanding and knowledge of the subject, and the ability to visualize and graphically represent concepts.

Natalie realized that there is a process to developing an infographic, "I kept thinking this is going to be a process that I've got to work through and you showed, yeah, you do, so that really made me feel better." She also explained that developing an infographic required a lot of thought and understanding,

> This would force them to actually show if they have an understanding. So that is what I like. Even if it is not perfect it would still make them have to really think about it. Like okay, how can I present this so that she knows that I understood you know, that section of the chapter.

She reflected on her own experience developing an infographic, "I really had to think, I mean, what I liked it was not even though you were teaching us through the whole training you challenged us throughout the training." She continued,

> I think that's why I liked it because it was new and it was something like oh my gosh this is so neat, and it also made me realize how you do have to have a knowledge base about your field that you know, and it made me feel good because I did have a knowledge base but it also it made me realize that, you know, you are kind of holding us accountable as an educator, to stay current and stay where we should be and that is what I liked.

"Visualize the concept" and "the drawing" were also mentioned by Natalie as skills associated with developing an infographic. She thought that having some type of visualization resource might help students in graphically representing the concepts on an infographic. Natalie commented,

> Develop a resource focused on your area, I thought, that's a great idea, cause then if I did develop something like that, I could share that with students, cause it's easy to copy things, you know, but to, to have to be fresh and new, that's a little hard.

Drawing vs. technology. Natalie shared that she thought the drawing approach would be a better option than using technology. She cites specific reasons and expands on the benefits associated with utilizing drawing for development of infographics.

> I think they would rather draw it, cause especially some students, some of my students, especially the non-traditional, I think that they could pick up on this and be fine because there isn't a lot of technology and plus you know, we've got

students that live in areas where their accessibility to technology is completely different from ours and so I think it would actually allow them to not feel as intimidated by it.

She continued,

I think, yeah I think we need to do this first, I mean, I don't see me trying to incorporate too much technology cause I think that, you get into the technology and this is something that I try to be really careful of in my online classes, is it that it becomes about the technology and not about the content. And you don't want it to be that way cause I've went to trainings where you know they talk about all these great little tools you can use and stuff, and it's just, it's overwhelming for me and I can't imagine if I was taking five classes and then they had all these different technologies everybody's trying.

Natalie adds that the drawing approach, if used consistently would mitigate student issues associated with drawing. She said, "I think if you had a consistent way of doing it and everybody was kind of initially doing the kind of the same thing I think they would get it."

Assessing with infographics – Natalie. Natalie thought that infographics would be a good way to assess learning. She provides several suggestions related to assessment. These thoughts and insights from Natalie about assessment are included in the Table 54.

Table 54

Assessing with Infographics - Natalie

Assessing with Infographics - **Natalie**	
Thoughts about assessing with infographics	**Factors influencing assessment**
• Good way to evaluate learning/demonstrate understanding • More authentic assessment of learning; hard to fake/cheat • New way of learning/measuring learning, something different • Really have to think • Reduce student test anxiety/not like a test anymore • Good way to see how students think on their feet • Use a rubric	• Grading challenges/considerations • Instructor interpreting student visuals **Suggestions for assessment criteria** • Grade content independent of artwork/graphics quality **Other assessment suggestions** • Make sure that instructor can develop infographic first

In the theme *Assessing with Infographics*, Natalie emphasizes the benefits of using infographics as assessment and discusses some factors that she believes might influence the grading of infographics.

Using infographics as assessment. Natalie shares that infographics can provide a way demonstrate the learning taking place,

> Oh yeah… this would force them to actually show if they have an understanding. So that is what I like. Even if it is not perfect it would still make them have to really think about it. Like okay, how can I present this so that she knows that I understood you know, that section of the chapter.

She adds that the infographic might provide another way of evaluating the learning and provide a way to evaluate learning in a broader sense. Natalie said, "Actually would be a good way for the instructors to see, you know, how they can think on their feet…" She continues with a similar concept,

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I think they need to have comprehension skills, cause you're obviously going to

have them read or study something so they have to be able to comprehend it

somewhat, but as a teacher it will help you see what kind of skills they have

another way.

Natalie shares a story with me about how she once taught a young student with

autism. She talks about how an infographic-type of assessment might benefit students

with different learning needs. She touches on how an infographic assignment might

provide students with an alternative approach to demonstrate learning.

This would have been so fabulous for him [referring to a former student with

autism] when he went on into the higher education if he could've taken tests like

this. So, there are a lot of kids that maybe their brains work a little differently, I

can see it really making the learning where you could actually, they could be

challenged to see where they really are at. So, and not so intimidated by it.

Eliminate cheating. Natalie mentions on a couple of occasions that the format of

the infographic might mitigate cheating on assessment saying, "…I think you can't cheat

on this [laughs]" and "There's no cheating going on here. [laughs] I mean [laughs] it

would be one way to kind of eliminate that…"

Influencing factors. One of the factors that Natalie points out involves the

challenge that an instructor might have in understanding what the student has submitted

and the time associated with grading an infographic.

I think it would be a nice alternative. I think that the only drawback, and not for

me, but for some people would be, is that, it's not, they would have to actually sit

down and read the material for the student to understand that they got it. It can't

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be like a multiple choice where it automatically grades it and feeds it out, but I think that, I think if you got the instructors to understand that, I think we've got to get away from like I don't try to test over an entire textbook, I think that is unrealistic and it's crazy. So I think that if you chose certain areas, and that's what I do, I just choose certain areas that I want to focus on, and use those, the smaller areas, and maybe just come up with five good questions where they have to develop an infomatic to explain it to you and then even have a small written portion to explain. I think that it would really, it would be a good way to test. I do, it would, and it wouldn't be a test anymore, it would be like a review

Suggestions for grading infographics. Natalie suggested that a rubric with specific guidelines could be used for grading an infographic.

Guidelines I would probably try to put in different guidelines cause I think students need that. They need guidelines or a rubric something where they can see if you have this you will get this, this is the outcome and for me it's kind of a safety net that's why I use them when I have students question a grade I always go right back to that and I say if you would have had this in here then I could have, you would've earned those points you know but because you chose to go this route you earned this amount of points. So you know, to kind of make it, and I think they need that so that it's up front and know you no worry about, you know, I mean for me as a teacher I do better if I'm looking at something while I'm grading.

Among these guidelines for a grading rubric I asked Natalie about how instructors might approach potential issues students might experience when drawing infographic

components. In her response she provides some additional information on how the issue

involving drawing skill and ability might be addresses. Natalie didn't think that the

quality of a student's drawing would get in the way of grading.

> You could even have them right a brief paragraph to kind of explain some of it in
> case they are afraid that, you know, and then that would be another element
> where, you know, it's like I always tell me students when they have to do
> PowerPoints, cause we do presentations through blogs and things, I always tell
> them that I don't want to see all of your information on your PowerPoint that is
> just your initial thoughts and then they have to develop something where I can see
> they've actually learned the topic or have an understanding, so that would be
> something you might want to do just an addition, just to be sure that you
> understand what they are talking about, you know. And I think to have them do it
> this way and then transfer to a written document like that, I think they would do a
> better job.

Participant Viewpoint - Tyler

Tyler has 14 years of experience teaching both in secondary and post-secondary

education. He teaches in the area of Mathematics and has an Ed.D. Tyler has some

experience with information visualizations but not specifically with infographics.

During the infographics training, Tyler developed an infographic to assist students

with the process of taking a proctored exam. Tyler indicated that students typically had

issues with the proctored exam process and he thought that an infographic might help to

clarify the process for students. Figure 36 displays Tyler's infographic about the

proctored exam process. He envisioned this infographic being included with or as part of

the course syllabus.
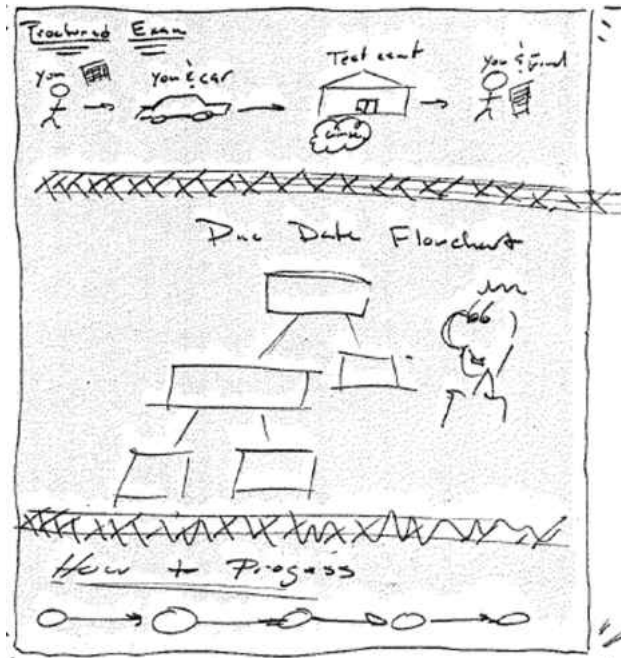
Figure 36. Tyler's infographic

Figures 37 and 38 provide a graphics overview of Tyler's comments and

responses associated with the infographic development experience.
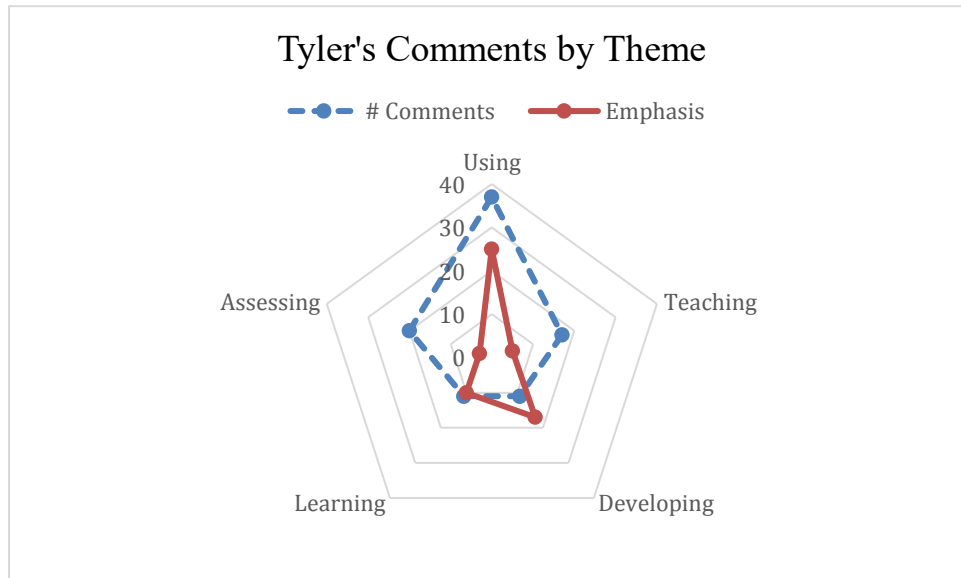
Figure 37. Tyler's comments and emphasis by theme. The dotted line in the figure represent comments made by Tyler related to the themes of this study. The solid line represents areas that Tyler emphasized.
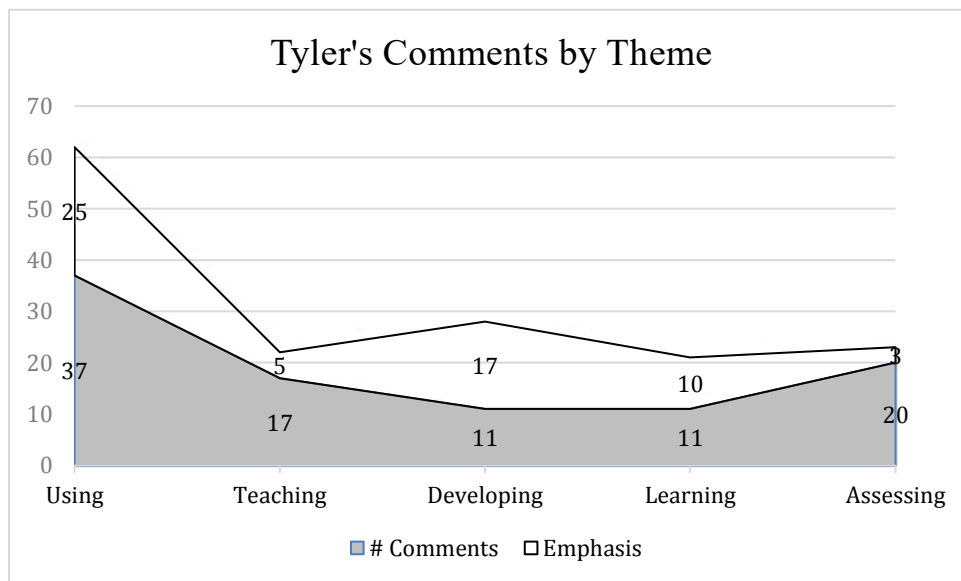
Figure 38. Tyler's comments and emphasis by theme – area chart. The area at the bottom of the graph displays comments made by Tyler related to each of the study themes. The area at the top of the figure provides additional comments made by Tyler emphasizing comments and themes.

Tyler's comments and emphasis are provided in Table 55. Based on Tyler's comments and the emphasis he placed on the concepts I categorized his experience as U-D-A-T-L.

Table 55

Tyler's Comments and Emphasis by Theme

	Theme	# Comments	Emphasis	Total
U	Using Infographics	37	25	62
D	Developing Infographics	11	17	28
A	Assessing with Infographics	20	3	23
T	Teaching Infographics	17	5	22
L	Infographics and Learning	11	10	21

Tyler commented the most about the theme *Using Infographics* (U). The next most popular theme was *Developing Infographics* (D). The themes *Assessing with Infographics* (A), *Teaching Infographics* (T), and *Infographics and Learning* (L) received a comparable level of comments from Tyler. The following sections provide additional information about each of these themes from Tyler's perspective.

Using infographics – Tyler. Table 56 provides a summarized version of Tyler's thoughts about possible uses for infographics. He emphasizes the use of infographics for helping students study and helping instructors communicate information more effectively. He also shares how using infographics might promote imaginative thought and provides examples of how he might use infographics as an assessment.

Table 56

Uses for Infographics - Tyler

Infographic Uses - **Tyler**
• Instructor notes, presenting information, communicating information
• Study guide/study strategy
• Assessment
o Formative
o Questions use as summative
o Pre or post assessment
• Student notetaking
• Syllabus
• Conceptualize a topic
• As an alternative to existing assignment
• Upper-level courses

Tyler provided several uses and suggestions for infographics in his classroom.

Study tool. Tyler thought that infographics could be used as a tool to help student study the mathematics content of his courses.

Yeah, if you, and you could hide it, you don't want to hide it, but you, you could rebrand it, to say this is, these are study tips, so, and cause there all we talked about like a graphic organizer and, and this infographic business, so it could be, it could be sold to the student as study tips and how to effectively study and organize your notes, that kind of thing, and you could give those extra tips as well, you know. That's your, what other people are saying that it can be used for all these different things. So in the way we did it, I think would work. Work with student development.

Communicate information to students. Tyler also thought that infographics could be used by the teacher to help communicate information to students better. The

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infographic that he developed fits this description of use. He wanted to help communicate a concept that student typically have difficulty understanding.

> I don't really know where I would use it as a teaching tool or an assessment tool I do know that I could use it to get across information another way so at the very beginning of a course, you know you're, I'm always wanting to get across information in the syllabus and then I started thinking about well what's the main questions that I get, because if I'm getting these questions over and over again then I'm not getting the information across or there not, or there, from my perspective, I'm letting them down because I'm not getting the information across and from their perspective whenever they're going over it they're not, they're not retaining the information so it's kind of a flipped, I think I'm doing it well, they have a lot of information to take in. so the process that I had, was that I wanted to get information across more efficiently and that they would be able to retain more information or get the information across in a different manner.

Opportunity to use imagination. Tyler shared that he thought that using a visualization activity in class might promote and generate much needed imaginative thought.

> I don't know if students anymore have an imagination and I don't know if it's a product of what but just seems to me when I was at the high school and now here, when you ask your students to think about something, to visualize it, they just have a, I swear it's just a blank, their mind is just black and they don't, they can't think of, you know visualizing so maybe if it forces them to draw it kind of forces them to think for once and not just sit there and stare out into space.

Examples of classroom use. Tyler shared that if he were to use infographics in class that the infographics would be sketched out and utilized to explain concepts. "I think, of what I would use it for is kind of, here's a rough back of the napkin use to explain something versus something you would see published somewhere." He also provided an example of how he would use infographics for assessment while also suggesting how the infographic might assist student notetaking.

> I would work through this in a couple of semesters and I would use it for summative, as formative assessment, as I worked through it and then eventually work my way up to doing it as some type of summative assessment. I would probably want to take a direction of using this for assessment but then I would also take it and use it as a form of a graphic organizer and notetaking so I would want my students to be able to use this in their notetaking, for notetaking skills, I'm kind of big on that, whenever I go, whenever I'm talking in my courses about taking notes. So that's probably another avenue I would approach it.

Tyler thought that there might be areas within his course that infographics might work better saying, "I would think there are certain, certain topics in the course that would allow for it to be pretty easy. He suggested that infographics might work better in other disciplines perhaps better than his own, stating,

> I would think that certain, probably certain disciplines use it more, you know, the more traditional infographics more than others, and, I can, you know, those things just jump out at me like I think you know if we're talking about Biology, or Anatomy and Physiology they, that's basically all they do is infographics, it's all a bunch of pictures and labels and a lot of stuff.

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Tyler suggests that the processes involved with the creation of infographics might already be taking place in classrooms.

I think that, you know, now that we've gone through this, there, there would be more places to, to incorporate this and I think, we might, we might already do it in the, most people probably already do this at a certain level, and when they teach and whenever they take notes, and whenever they, you know, organize their, their thoughts, I think they kind of do this anyways. And it's just a way of, of saying well this is, this is what you've been doing anyways and here's some other things to build on that and try to incorporate it into doing this and that.

Factors influencing infographic use - Tyler. Tyler commented on challenges or influencing factors that might impact the use of infographics in post-secondary education. Table 57 provides an overview of the concepts he mentioned during the interview. These factors are grouped into teacher-, curriculum-, time-, student-, and skill-related influencing factors.

Table 57

Factors Influencing Infographic Use - Tyler

Factors influencing use of infographics in post-secondary education - **Tyler**	
Teacher influences • Teacher not open to trying something new • Resistance to changing method of teaching; status quo • Instructor understanding content enough to develop infographic • Instructor knowing how to follow steps to develop infographic • Teacher resistant/hesitant to change • Resistance from teachers (general) • Moving away from lecture • Different from what currently doing; teaching style conflicts • Perception that infographics might be childish • Teacher adoption of infographics • Extra work	**Time influences** • Takes time to learn (learning curve) • Extra time needed • Time away from other content; having to work in **Student influences** • Student population, generational, cultural consideration • Learning style/Learner type considerations • Potential resistance from students/student frustrations • Visual impairments • Extra work • Lack of imagination **Skill influences** • Drawing skill set/abilities
Curriculum influences • Difficulty determining best fit in a particular class, where to use • Curriculum/program restrictions/common course/common final • Differences by discipline/class type/assignment type • Course level considerations	

Teacher-related influencing factors. Tyler thought that teacher's might be resistant to using infographics for various reasons. Among these are teaching styles and a general resistance to changing methods of teaching. He stated, "It's going to be a challenge to try to move away from the, the basic ways, you know, the basic way we do things right now." He continued, "I think also you're going to be fighting, challenging the status quo, how to do things…" Tyler commented that teachers might think that an infographic assignment was 'childish'. He suggests, "Yeah, I think that if you don't watch out people will assume that you're breaking out the crayons and you're being too childish in a way, you know, I think some people kind of are opposed to that…"

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Tyler continues,

The sage on the stage wouldn't want to do something like that, so, but you know, you're you're syllabus would look like, you know what do you need for the course, textbook, paper, pencil, crayons, colored pencils, that kind of thing would look weird you know, but it's fine, it's and it works, I just think that one might be, I don't know if it goes there, but that might be a stumbling block. But I think it, it, it, I think it has a place in any, in any educational setting whether it's my discipline or anyone else's whatever stage you're in in your educational process.

Tyler also suggests additional teacher-related considerations involving attitudes, skills and abilities, and cautions about the teaching accomodations that might be necessary to assist visually impaired students.

I think you need to be open, you need to be a person that's open to show, to be able to not just draw but to draw and then share with someone else their drawings right, you need to be open that's kind of a characteristic of a person that would do this. Skills and abilities artistically are not that great, maybe you know, if I look at another post-secondary challenge would be this ADA requirements of someone that's physically couldn't, you know draw or things of that nature.

Curriculum-related factors. Tyler describes several curriculum-related influences to infographic use. Among these were determining the best place to use infographics in a class, the influence of course type and class type, and the influence attributed to common course and/or common final approaches.

Finding the best place for infographics. Tyler thought that infographics had a place in his discipline but he was not sure where it could be best used. Others in the

cohort had mentioned specific applications in their respective classes but Tyler was still unsure. He commented, "I really didn't know, cause some other people knew where to put these things in their class where a student could, could use them but I, I at the point I'm at I really didn't know. Tyler continued to reiterate that he thought infographics could be used in his Mathematics classes but still questioned where it could be best utilized.

> I think it could be used, I think it has a place, where? I don't particularly know yet and when I don't, I mean it's just one of those things I don't know about, I kind of have a feeling it, it has a place, it's kind a like those, the clickers we were talking about a second ago, it has a place in there, I just, where do you use it and when, when do you use that teaching tool?

Tyler returned to this line of thought at several points in the interview. He describes having difficulty knowing exactly how he would use infographics in his subject area and indicates that he would be looking for places to infuse the infographic assignment.

> Sure, I mean, it's educational context you know, like the one I worked on in the training would be useful and I can see where I could apply that in other, in other places. What I have trouble with, at least in the math part, was using it for trying to, I'm not saying it can't be done, it's just, I would have to wrack my brain and really keep this in the back of my, in the back of my thoughts whenever I go through a course kind of thinking when would this be a good time to interject using an infographic? So now it would probably be an idea where I'm keeping it in the back of my head and it's another tool in the toolbox so to speak. So, it

would be hard for me to come up with a list of here's what I'm going to do, here's

what I'm going to do, here's where I'm going to use it, but when I go through a

course now, it's always going to be kind of one of those things where hey I think I

could use this here.

He elaborates further stating, "At this point, that's what it would be, it would be

just kind of going through the course again, and really taking it, as I teach it, and thinking

about having this in the back of my head when I could use this next time, or if can, or if

it's something that's coming up I can use it, you know."

Course type/level considerations. Tyler suggested that infographics might be

better utilized in a unique or upper-level course rather than an introductory course. He

explains.

Now if you look at one you know we offer, only have one person teaching stats,

so maybe they look at their courses or something you know, upper level courses

would be interesting to see because its I think it would be an easier fit, an easier,

just off, just coming off the top of my head I think that it would be an easier fit in

upper-level courses to do this kind of thing.

Another course type or course level factor mentioned by Tyler was the influence

that a common course or common final structure might have on the use of infographics.

Yeah, if you, if you're in post-secondary, and you have to, there is a smaller

subset of problems that you don't get in pre-secondary, or in secondary, so one of

those things I think would be a commonality that we have in certain courses.

He continued talking about how a common course and/or common final

structure as an influencing factor, "You know, if these courses are, are common

courses then you know assessment wise, you know common course where

everything needs to kind of look the same from instructor to instructor…"

Time-related influencing factors. Tyler mentioned how time-related factors

might influence use of infographics in post-secondary education. He explains that teacher

may not feel they have enough time to incorporate into an already time-constrained

course. He explained,

> You're going to hear that from a lot of faculty, I don't want to waste time on
>
> teaching people how to draw stick figures whenever I can't get through my
>
> content to begin with. So that's going to be a common complaint I would think.
>
> So it would put another step in the process for students as well cause they would
>
> have to go through it and learn about it. But if it's an hour, thirty minutes to an
>
> hour, couple of bite-sized chunks that they could go through throughout the
>
> semester, if you can break it up throughout the semester, it would just be a couple
>
> of minutes here or there, I don't think it would be an issue.

Student-related factors. Tyler focused on how different generations of students

might react to an infographics lesson. He suggested that students that have already been

exposed to infographics or visualization activities might have an easier time with

infographics than students not previously exposed to an infographics activity.

> Yeah, if they've seen these things [infographics] from kindergarten on, then it's
>
> not a big deal and it shouldn't be a big deal in post-secondary if they've seen them
>
> through the whole process, but you know, we have a lot of non-traditional
>
> students that haven't been there, right, so.

He also suggests student demographics as one of the main drivers impacting the decision to use infographics. "I think that would be the main, the main impact of, of, you know teacher adoption, students, types of students you got and your population." Tyler points out that differences in learning styles might influence a teacher's decision to use an infographics-type assignment suggesting that some students might prefer other means of demonstrating learning.

> I wouldn't want to shoe horn everyone into that category, cause they, you know, the seven types of learners and all that jazz I think everyone is probably a little bit of every type of learner but some people are more, would like to just write out a sentence and there more of that type of person so I wouldn't want to shoehorn or force anyone to, say this is what we are going to do you have to do it this way, I hate to do it that way. For some people, they wouldn't try it though unless you forced them so, you know it's kind of the other thought we talked about people don't think they can draw either, so that might be a negative.

Developing infographics – Tyler. Table 58 displays the concepts Tyler mentioned regarding theme "Developing Infographics."

Table 58

Developing Infographics - Tyler

Developing infographics - **Tyler**

Skills required
- Mastery, understanding of content
- Ability to visualize and graphically represent concepts
- Basic art skills/abilities
- Open mind
- Following steps to develop an infographic
- Selecting/Coming up with an infographic topic

Other considerations
- Drawing over technology tools
  - Reason – lessons the learning curve
- Technology over drawing tools
  - Reason – current generation of students
  - Reason – finding images, clip art, other media

Mastery and understanding of content. Tyler shared that developing an infographic required an in-depth understanding and knowledge about the topic of the infographic. He said, "You need some type of mastery of the content to effectively, to effectively make an infographic." Tyler added, "It would be very frustrating for students because if they don't understand it [topic/subject] then they couldn't do this [develop infographic]." Similarly, Tyler shared this comment, "If someone felt pretty confident in how to explain something to somebody, surely they can do it in picture and infographics." He expands on this concept by sharing advice for someone developing an infographic.

> You know if they, if they made this infographic I would be, the advice I would give the student, is that they should be able to take this and hand it off to someone that's never been in the course that has, you know, very basic skills about this, and be able to look at it and say, oh yeah, that makes sense you know what I

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mean, so, that would be part of my rubric but than that would also, that would also mean that they, they understand, they would completely understand how to do something.

Tyler reflects on the learning process both for the infographic itself as well as the content being learned for the infographic.

Are they learning or are they reinforcing their learning you know, which one is it and if cause if they have no idea how to do this then they have to learn to do it and then do, and then do the infographic or if they completely understand it, they should have no, they should have no problems in, in, in displaying it. As long as they, as long as they have the right tools to tell what they are trying to get across.

Challenges visualizing and drawing. Tyler suggested that students might find the visualization and drawing processes associated with infographics challenging.

Once I did find something that I wanted to use for it, you know, it's almost like staring at a blank canvas and you're thinking well what am I going to do, what can I do so if you don't have, if you don't have a big, a large skill set, you'd wind up repeating, rehashing the same kind of thing over and over again, so you know, building your skill set would probably be difficult, of how to, what, how to draw something by hand, if you wanted to do it by hand.

He commented, "I think someone's going to be very, someone has made fun of their stick man somewhere down the line and they're going to be very defensive about the way they draw I think, yeah." He then summarized the challenges associated with develoing infographics.

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I think your main barriers for students are going to be the time component of

going through a training to make sure they understand what to do, do they have a

skill set, a small skill set to draw with, or the ability to get clip art, and then do

they completely [understand the material], they didn't really understand the

material to begin with.

Drawing vs technology tools. Tyler thought that students could utilize online

multimedia as an alternative to drawing infographics. He suggests that images and clip art

as options.

I think using a picture and try and find those kind of pictures cause I think a lot of

people, a lot of young folks these days like these memes, and looking at memes

that way so, if you get, if you try to get grumpy cat up there trying to do

something, surely that sticks out.

Tyler continued,

If it was me, you know, I think a lot of students I think they can google something

and come up with an image pretty quick. I wonder if some people would, I think

some people would flock more toward to a tech, you know, if it was me and I had

to do something I would go towards trying to find images, clipart versus drawing

something by hand.

Tyler said that he would utilize drawing as a first option to be supplemented with

technology applications if available. He explained,

Well if, if I was going to do this thing, I would probably, I would draw it out first

kind of thinking about what I want, and then I would look at the technology part

and see what's available cause there might be something in the technology part that I didn't even think about.

Tyler added,

Or there might be something limiting in the technology part that I couldn't do so, it's always like having more tools in the toolbox is always good. I would, I would, I would sit down and draw it out first, and then, and then try to apply some type of, just a rough draft, basically what I'd be doing, I'd want to draw, be able to draw out a rough draft and then if I wanted to try and apply something like PowerPoint or clipart or that kind of thing. I think it would be a lot easier to do it that way.

Assessing with infographics – Tyler. Table 59 provides a listing of the comments Tyler suggested relating to the theme *Assessing with Infographics*. Tyler provides comment relating to his thoughts about using infographics as assessment, provides benefits associated with infographics as assessment, discusses challenges grading infographics, and provides insight and suggestions on how to grade infographics.

Table 59

Assessing with Infographics - Tyler

Assessing with Infographics - **Tyler**	
Thoughts about assessing with infographics	**Suggestions for assessment criteria**
• Good way to evaluate learning/demonstrate understanding • New way of learning/measuring learning, something different • Quicker, more efficient form of assessment • Formative assessment • Reduce student test anxiety/not like a test anymore • Changes the way teachers grade • Use a rubric	• **Content independent of artwork/graphics quality** • Depth of understanding displayed, key concepts clearly communicated • Level of detail, specific facts • Understanding of process, logical connections, thinking • Logical flow
Factors influencing assessment	**Other assessment suggestions**
• Grading challenges/considerations • How to grade fairly; subjectivity of grading • Common assessment practices within discipline (common finals) • How to grade art	• Make sure that instructor can develop infographic first • Lower expectations early on • Start with formative assessments working way up to summative assessments • Incorporate as part of note-taking strategy

Using infographics as assessment. Tyler commented that he thought infographics could be used to assess student learning. He said, "Yeah, I'm for it, I would try to use it if, where I could." He added, "I mean, I think it would help, I don't see why, I don't see how it would hurt." He went on to say that infographics could be used as an assessment "at any time frame in your education process, so pre or post."

Quickly evaluate learning. Tyler suggested that using infographics provided a quick way to evaluate student learning. He explained,

> If I had to read a five-page paper from everyone over the same topic it's going to
> be the same thing rehashed over and over again right, so it would be definitely, it
> would be good from my, on my end of it just to make sure I could make a quick,
> quick look at how, how they're learning; you know why grade ten problems
> whenever you can just if they can explain the process real quickly.

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Challenge with assessment in subject area. Tyler suggests that there might be

some students that could potentially resist using infographics because learning

infographics would be in addition to the course content. He said, "I would think some

students would be pretty, they'd be pretty, don't want to say mad but I think they would, I

think they would get frustrated that you would be doing this on top of something else."

He continued with this thought that adding something like an infographics assignment to

an already challenging course might create additional challenges for students.

> That [assessing with infographics] might be a problem in the mathematics parts
>
> because the math is, I don't know which comes first I don't know which fixes
>
> who but you know the mathematics is so hard do you want to throw an
>
> infographic, another training in that thing on top of it, or does throwing an
>
> infographic part training on top of it better explain.

Challenge to grade infographics. Tyler shared that it might be

challenging to grade an infographic fairly indicating that having validity in the

grading process may prove difficult. He discussed how the grading would be

different than that associated with traditional forms of assessment and provides

insight into formative and summative aspects associated with infographics.

> Assessment wise it would just be along the lines of a way to grade it fairly across
>
> multiple students, you know, that, you know, is your grading valid? Are you
>
> going to just give everyone hundreds or is there a way to really delineate between,
>
> well you know, is, is the a,b,c,d,e, is that, is that mindset applicable to
>
> infographics? Cause how do you know, is this, how do you put eighty percent on,
>
> on that, I don't, I don't, do you, do you put points to it, I just don't know, I don't

know how I would assess them, I like to use them as assessment to see, maybe, as a formative assessment, something that wouldn't be so, you know, so concrete, you know, so, formative would be great, summative I don't know. It would be hard for me to use it as a summative type of assessment that would be gradable in the way we do things now using, you know, the traditional A through E method.

He continued to reflect on how summative assessment might prove challenging. "I don't know how you would [implement] the grading scales and grading distributions, I don't know how that would work for summative assessment."

Tyler points out that using infographics as assessment may have specific challenges but those challenges may result from a lack of understanding about the subject being assessed.

They're going to struggle at drawing something some people are, some people are going to have struggles because they don't really understand the material to begin with, so if we're going to use this for assessment I think that's going to be their issue. You could give them ten questions and their going to get a zero and you give them an infographic their going to get a zero because they just don't understand.

How to grade an infographic. Tyler shared how he would approach grading an infographic. He describes his thought process behind the assessment and reflects on current assessment practices.

I would probably sit down and try and grade these things, you know, as fairly as possible from person to person but I think it would have to be along the lines are they showing, is there a true display of understanding. Do you understand what's

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going on with this content, if we were going to try and assess that you understand

this content, then you would have to really be able to show it and how they

showed it, it would be, I guess, some type, would be surprising for different

people, right the way they described it. Going back to what I said in class where I

had someone translate a definition into their own words or what are you doing to

memorize this rule and I go around the room and ask you know [it is] usually the

same thing over and over again but then I get one or two people that surprise me.

Rubrics and grading criteria. Tyler suggested that he would use a rubric to grade

an infographic. He also shares concerns about how to assess student artwork.

"Yeah, when I hear the word assess I think of rubric, especially coming from the high

school part where everything was graded on a rubric and then, but then the flip side, an

infographic is so artistic, I mean, how do you, you can't really put a rubric on art, so to

speak [laughs]. I find that hard to do just, because I've not done it before…" Tyler did

provide grading criteria that could be included in a rubric for assessing infographics.

> If it's a process, if the topic is a process then sure you want to make sure that
>
> their, part of your rubric would have to be, are you, did you completely describe
>
> the process, you know, did you display complete understanding of this process or
>
> complete understanding of the steps it would take to complete this.
>
> Tyler suggested some questions related to developing the criteria for the rubric.

He asked, "Would you want a whole, you know, do you want every detail, every minute

detail, what, what detail would be critical? He continued,

> What details are, would you, whenever you grade them, what details would,
>
> would be worthy of, of a picture and what details would you, who decides, and

it's to the extent of, of when you show your work, how much work do you need to

show.

Teaching infographics – Tyler. Tyler's comments relating to the theme

Teaching Infographics are included in Table 60.

Table 60

Teaching Infographics - Tyler

Teaching Infographics - **Tyler**	
Preparing to teach an infographics lesson (thoughts) • Additional infographics training • Realize that everyone may not know how to develop an infographic **Planning and preparation** • Need time to learn before teaching someone else; teacher needs to know how to develop an infographic • Provide time for practice • Instructor use of infographics • Incorporate over period of time; multiple phases; more than one semester **Instructional practices** • Teacher uses infographics in class; models use throughout course • Use technology/internet/images/clip art; other media	**Instructional practices (continued)** • Provide examples/samples • Start small, simple, slow • Demonstrate, work along with students • Use groups **Learner support** • Provide tools, resources, cool stuff • Don't just introduce concept without support • Provide technology training for those that would like to use technology tools

Teacher understands how to develop an infographic. Tyler's suggested that it

was important that teachers understand how to develop an infographic before attempting

to use in class. "I would want to sit down and see, can I do it, could I make one of these

things out and if I couldn't do it, if I would have a hard time doing this then I would want

to try to use some other form of assessment."

Start small and simple. He recommended that teacher's using infographics start

off small and progressively increase the complexity of the infographic assignments.

And for just starting off, if someone's going to start off using these things, I think

it's nice to use small ones then you kind of build your way up to, to getting to a

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full, …a full-fledged, publishable type of infographic, that's kind of the difference.

Model use of infographics in class. Tyler commented that it was important for teachers to demonstrate and use infographics as part of the instructional process providing students with an example of how infographics are utilized.

I wouldn't want to just slap this and say okay, here is your first assignment, make an infographic, right, so no one knows what their talking about that would be complete chaos, I don't want to, I want to minimize chaos whenever I can so that would be something I would want to model in class and then let them model it on their paper in class and work on it almost like a I do, you do, we do, kind of thing…

Tyler continued,

I would want to model this throughout the course, and then, even if it's face to face, I would definitely, you know, I'd model something in class and then I would walk around to see what everyone else is doing, I would encourage people, and say oh this looks great, and I would want to share it with people, you know that kind of thing, where I would, try to foster good, happy thoughts about it, right, good attitudes.

Use groups. Tyler suggested that using groups could be beneficial for students.

That would be good too, cause if, if someone, if people were individually then they might get stuck and then they'd be like I have no clue, maybe if they're working in groups, and then they all, they could all work on one thing, I suppose,

or they could work in groups and then come, and then, bust out and do it

individually, that'd probably be a good idea to do I think.

He continued,

I think you do want that small group, you know comparing, you'd be, you'd show

a couple of examples and everyone sees how they can use it. I think it needs to be

a small group type, not that it has to be, you have to be three people at a time, but,

a couple, four or five small groups is about all you could probably manage I

would think, doing it in the way that we did it.

Infographics and learning – Tyler. Table 61 provides an overview of concepts

Tyler mentioned related learning associated with infographics. Tyler provides insight

and perspective on how he believes infographics influence learning. Tyler suggests that

developing infographics is a process similar to teaching. He describes how he believes

infographics impact learning and reflects on the overall learning associated with

infographics.

Table 61

Infographics and Learning - Tyler

Infographics and Learning - **Tyler**

Emphasized Concepts
- Promotes in-depth understanding; perspective
- Infographics as a teaching activity (teach to learn); being able to communicate understanding to others

Other Concepts
- Promotes critical thought, higher-level thinking, critical analysis
- Reinforces learning; retention and recall; memory/study aid
- Promotes visualization skills; visually communicate understanding
- Meets needs of different learning styles; learner needs; might not be for everybody
- Something different; another form of learning, new ways of learning/challenging students
- Find connections in content; conceptualize a topic, identify patterns
- Stimulates engagement; encourages attention; students connect with this more
- Fosters creativity and imagination
- Encourages thought, deeper thought; rethinking

Teaching to learn. Tyler describes how developing an infographic goes beyond the graphics requiring a level of knowledge about a subject to the point where it can be visually communicated or taught to someone else. "This isn't all about being able to draw something, it's all about being able to understand your topic and be able to, what's you want to do to display your data or to explain it to someone." Further, Tyler describes this process as teaching to learn, "Cause basically you're re-teaching it, you're teaching it to someone." He adds, "You are trying to teach it to somebody."

Increased understanding. Tyler reflected on infographics influences to learning explaining how the process of developing an infographic promotes learning.

I think your outcomes are learning, I think you are really learning, learning a little

bit better because you are more engaged in the, in the content. And even

whenever you are trying to display data you know, you start looking at the data

you start getting more engaged in the data and then patterns start to emerge that

you probably didn't see beforehand, so patterns, I guess outcomes would be you

start to see patterns, you start to see, you start to really get, in-depth, you need to

have a pretty in-depth understanding of the content to begin to display it as an

infographic.

Tyler continued,

I would think that if when they start with the subject they would have to sit down

and really analyze what they're trying to talk about and it would, at the very, at

the very minimum, it would reinforce concepts, it would reinforce that concept

just a little bit better, so I think it would help student learning.

Tyler suggests that the process of developing an infographic influences learning

by requires students to internalize the content in a way that make sense to them.

Yeah, I mean, if you, it's just one more way of, for a student being able to,

conceptualize a topic. So a lot of times, I will put a definition on the board from a

textbook and it you know math is always a second language to most people

especially reading it's very hard to read so we will sit down and we'll try to break

it down so what we will do we'll discuss it then I ask everyone to make their own

definition define it in their own words then we go around the class and we discuss

it everyone's. So that's the same thing if you could have someone create a

concept as an infographic it's in a sense developing that content or that topic in

their own words and it's just one more way that bit of information just stick it in their head just a little bit more. I've always told them you want these things to be a splinter, you want to push it down nice and deep so you can't get the thing out, right? You want to learn this stuff so you can't dig it out.

***Overall learning impacts*.** Tyler reflected on the overall impacts of infographics revealing insight into the underlying influences of his training experience developing infographics.

There's a lot more to it than just making a pretty picture, right, that's kind of the idea that I would want to get across to people. Because everyone sees the nice publishable ones, and it's more to it than that. It can be applicable in different, a lot of different ways.

He continued, an "Infographic doesn't have to be big and complicated to be useful" He shared that the format of the infographic was not essential to achieving the purpose of the infographic.

I thought it was very beneficial for me to know that you don't have to make a big computer generated infographic to make it useful in a course or to make it useful to display any type of information so, it doesn't have to be a huge infographic, huge time constraint, something I can implement, just take some of those ideas of basic infographics, or basic drawing techniques, to get across some other ideas to, to either my students or to whoever I'm trying to give information to.

He continued,

Yeah, so before, before this when you asked me to do it, you said infographics, I knew of the nice, computer-generated infographics that you see, and now

afterwards, it's, I think it's much more than that, it's more, it can be hand drawn, it can be an organization of notes or of ideas, it's a way to visualize and display your data in, in a bunch of different ways. It's more of looking at something and really understanding what it's about and then that draws out your, any, any kind of comparisons that you probably wouldn't have seen to begin with so yeah, that's kind of where I would fall afterwards.

The preceding section was intended to provide an overview of the experience from the participant perspective sharing how each participant reacted and reflected about the infographic development experience. Many of the concepts covered in this section are also included in the sections that follow related to the cohort perspective. In the next section, the cohort experience is explored.

Cohort Viewpoint

In the previous section we explored the infographic development experience from the perspective of each participant. Each participant's perspective was presented to provide an overview of each participant's insights and thought about their experience developing an infographic. In this section, the perspectives of the cohort are presented. The cohort viewpoints narrative contains the findings of the study from the perspective of the group. The cohort itself received an experience classification and the cohort viewpoint narrative provides overview and detail relating to each of the study's main themes. The cohort point of view is provided to collectively see how the group experienced the infographic development process. When combined with the individual participant viewpoints, the cohort viewpoint narrative provides the big picture view that I am seeking. I thought it important to see how individuals responded to the training

experience but equally important to see how the group experience either reflected or contrasted the individual experience. The cohort viewpoint narrative is structured around each of the five (5) themes. The thematic narrative contains cohort perspectives on each of the themes providing detail tables and supported by participant insights. The cohort findings are presented by theme and provide an overview of participant responses during the interview and include detailed tables related to each of the themes of this study and provide comments from both individual participants and participant groupings. Figure 39 provides a graphical depiction of the areas of comment and emphasis from the entire cohort summarizing the results from the first part of this chapter and provides an overview of each participant's experience developing infographics.
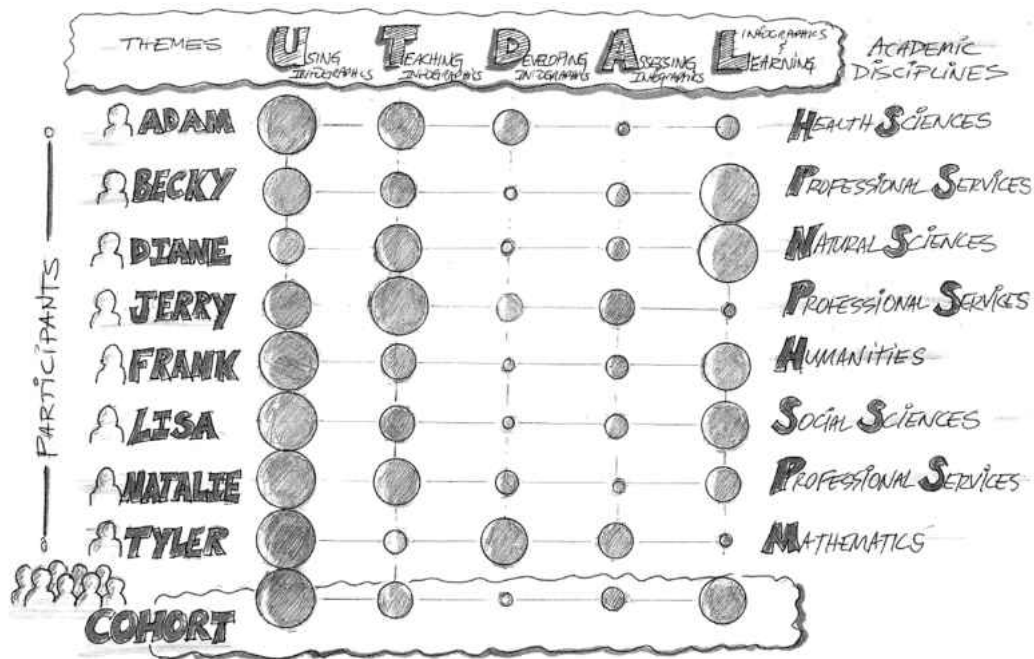
Figure 39 – Cohort insights and perceptions overview by theme. Themes of the study are positioned at the top of the figure with participant names along the left side and corresponding academic disciplines along the right side. Spheres are displayed to represent the comments made by participants. Size of the sphere corresponds to number of comments. The largers the sphere, the more comments were made. Cohort spheres are along the bottom to provide comparison with participants.

The participant cohort had an experience classification of U-L-T-A-D. This same categorization was used to describe each participant's response and reflection regarding the infographic development experience and is utilized for the cohort to provide a method for comparing and contrasting individual participant thoughts to the overall training cohort. For example, only Lisa and Frank share the same experience classification as the cohort (U-L-T-A-D). As a whole, the cohort emphasized the theme *Using Infographics* (U) the most. The theme *Infographics and Learning* (L) was next in line followed by the themes *Teaching Infographics* (T), *Assessing with Infographics* (A) and finally, *Developing Infographics* (D). The cohort findings are presented using this order of emphasis. The narrative of this section describing the results of the study related to the cohort will have some duplication from the participant sections. This duplication is intended to identify areas of similarity and/or contrast among the participants of the cohort.

Using infographics – cohort. I wanted to find out what the participants thought about using infographics in their specific discipline and in post-secondary education in general. I was also interested to see if there were perceived differences using infographics across academic disciplines and class types. Participant responses were analyzed and grouped into the following subcategories:

- thoughts about using infographics in post-secondary education;
- subject discipline and course-related considerations;
- perceived factors influencing infographic usage in post-secondary education;
- and thoughts about how infographics might be used in post-secondary education.

Figure 40 provides an infographic view of participant perceptions related to using infographics in post-secondary education.
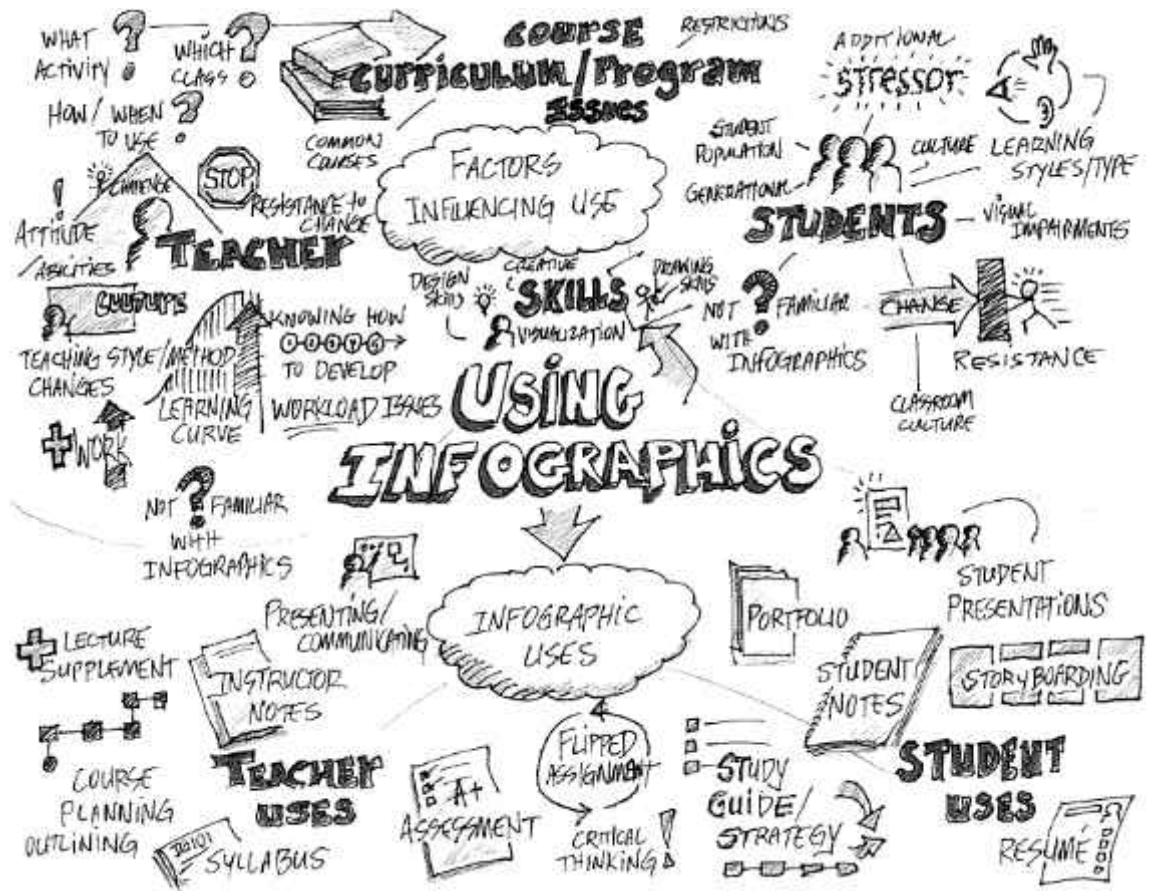
Figure 40. Cohort perceptions about using infographics in post-secondary education. Infographic depicts participants comments associated with using infographics. Emphasis areas include factors influencing use of infographics from the teacher perspective, student perspective, and influences associated with course/curriculum/program issues. Uses for infographics also depicted.

Thoughts about using infographics in post-secondary education. All

participants thought that infographics could be used and have a place in post-secondary

classrooms. Becky, Diane, and Natalie did not think that the subject discipline influenced

the use of infographics. All participants indicated that they thought that discipline and

class type were to be considered in the decision to use infographics. Although all

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participants viewed discipline and class type as considerations, only Becky, Diane, and Natalie thought that discipline did not really matter to the usage of infographics. Most participants thought that subject discipline and class type played a role in the use of infographics.

Do infographics have a place in post-secondary education? All participants thought that infographics could be used and had a place in post-secondary education. However, each participant had different thoughts about how infographics might be used within their discipline and other disciplines in post-secondary education. Discipline, class type, and topic choice were considerations participants shared.

Some did not think that discipline was an influencing factor. Becky, Diane, Natalie, and Tyler perceived that using infographics is not related to a particular subject or discipline indicating that they thought it could be used in most disciplines.

> I actually, Science, I mean, Music, I can't think of a, a discipline it wouldn't work in, and any of the hard techs it would work, welding, electricity, you could definitely find information there to do an infograph on. -Becky

> "I don't know that there's any discipline that it wouldn't be helpful." -Diane

> "I think that about every discipline could use this, I don't think that there would be a discipline that couldn't use it, they may use it in a different way." -Natalie

> "I think it has a place in any, in any educational setting whether it's my discipline or anyone else's whatever stage you're in in your educational process." -Tyler

All participants indicated that they thought that discipline and class type were to be considered in the use of infographics. Some participants thought that subject

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discipline, class type, topic selection, assignment type, and course level played a role in the use of infographics.

Subject discipline considerations. Adam, Frank, and Tyler suggested that infographics might work better in some disciplines than others.

"And then as far as post-secondary education in general I can see for certain classes very likely." – Adam

"I think the possibility is there, again, maybe more so with some subjects, disciplines than others, possibly although I'm not sure about that." – Frank

"I would think that certain, probably certain disciplines use it more, you know, the more traditional infographics more than others." – Tyler

Class Type Considerations. Frank and Becky both touched on an aspect of class type that involves the acquisition of factual knowledge or what Becky referred to as "artistic versus factual-based classes" indicating that the she thought that the infographic assignment might need to be designed differently based on the type of class. Frank said,

I could definitely see for a class, a type of class or discipline that involves, what do I want to say here, the content, just acquiring knowledge, you know, so anything that you might test for or, you know, ask students to, convey a, process, or a set of facts, or just information in general, I could see, that more easily, how this would apply to that.

Topics used. Tyler had indicated that he thought infographics could be used in other disciplines but commenting that "I would think there are certain, certain topics in the course [mathematics] that would allow for it to be pretty easy." Adam added, "It's not

for every single topic but there are certain things that it lends itself to especially when you are trying to get a broad amount of information in a concise format."

Assignment type differences. Jerry pointed out that there might be a difference between assignments in which the data for the infographic was given to the students as opposed to an assignment in which the student was required to collect the data themselves. Jerry said,

> I think most times you would use this like you said in other general education, they would be looking up the data to put the information you know, to start from scratch where we're going to give them the data and have them put together the infographic that goes with it so, big difference there [laughs].

Course-level considerations. Natalie and Tyler indicated that there might be a need to introduce infographics in upper-level courses citing the need to reduce student stress and that upper-level courses might be a better environment for introducing infographics.

> "I thought I would do it with one of my upper-level classes not my 101 or 102 cause those students, some of them it's their first opportunity to be in a blackboard class and that's enough stress. " – Natalie

> "Upper level courses would be interesting to see because its, I think it would be an easier fit, an easier, just off, just coming off the top of my head I think that it would be an easier fit in upper-level courses to do this kind of thing." – Tyler

Factors influencing infographic use - cohort. Participants shared several factors the perceived to influence the usage of infographics in post-secondary education. The

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infographic in Figure 41 provides a more detailed view of the factors mentioned by participants.
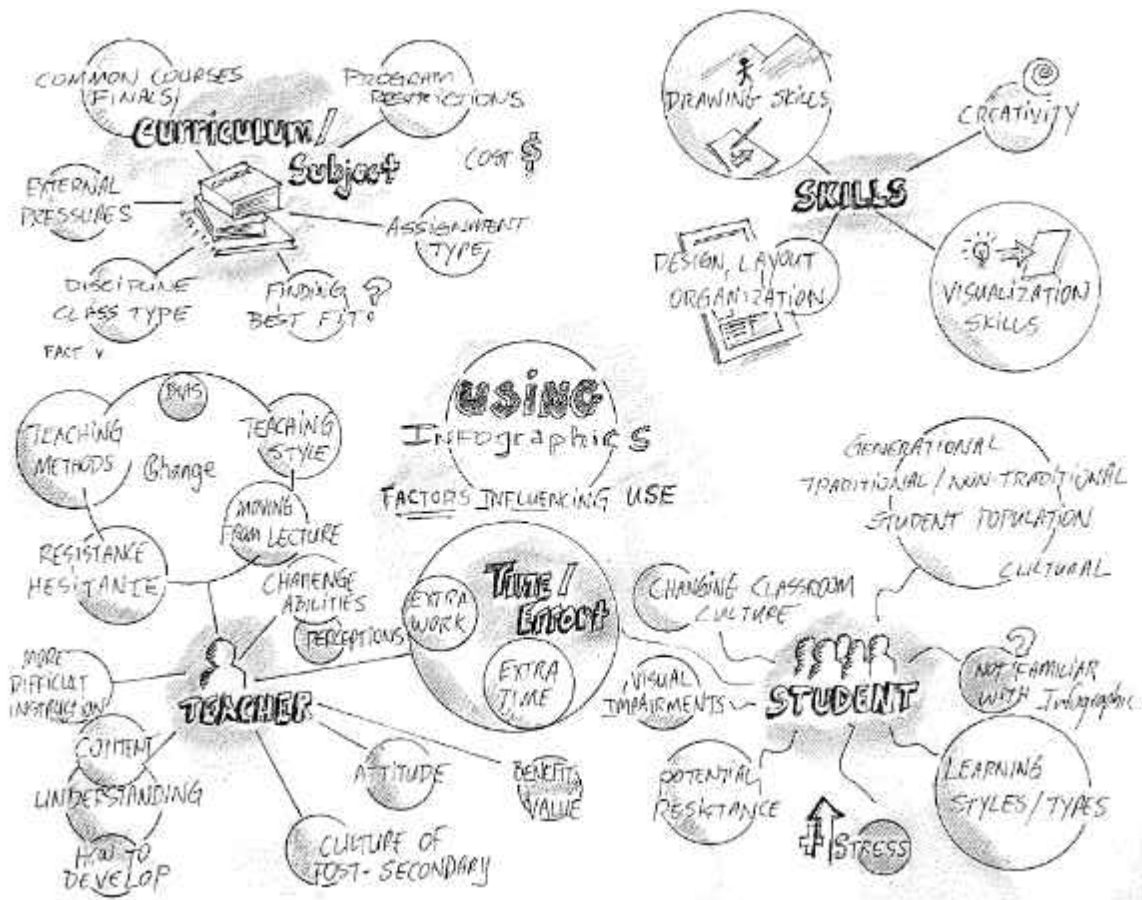
Figure 41. Factors influencing use of infographics in post-secondary education – cohort perspective. Infographic depicts participant comments associated with the factors that influence the use of infographics on post-secondary education.

Participants identified several challenges or factors that might influence the teaching and/or utilization of infographics in post-secondary education. Table 62 provides a listing of the factors the cohort described as influencing the use of infographics in post-secondary education. Overall there were 49 different factors identified. I grouped these factors into five (5) categories including, skill-related factors, teacher-specific factors, learner-specific factors, assessment-related factors, and curriculum/program-related factors. An instructor's resistance to changing the way they

taught along with the extra time needed to incorporate infographics were identified as the biggest factors facing use of infographics in post-secondary education. Overall resistance to change, external pressures involving curriculum decisions, and instructor attitude, instructor enthusiasm and institutional culture were also identified as factors. Other factors influencing the use of infographics in post-secondary education include the cost to provide materials for an infographic activity, teaching style and the student population.

Table 62

Factors Influencing Infographic Use – Cohort Perspective

Factors perceived to influence use of infographics	#	Participant Comments							
		A	B	D	F	J	L	N	T
Skill-related factors									
Artistic/drawing skills and abilities	8	•	•	•	•	•	•	•	•
Visualization skills and abilities	7	•	•	•	•	•	•	•	
Design, layout, organization skills and abilities	4	•	•	•	•				
Creativity skills and abilities	2	•					•		
Teacher-specific factors									
Time and effort									
Learning curve, extra work, time factors involved	8	•	•	•	•	•	•	•	•
Time away from other content; having to work in	4	•			•	•			•
Time and effort required, payoff worth investment	3		•		•			•	
Teacher attitude and abilities									
Teacher not open to trying something new	6		•	•	•	•		•	•
Resistant to changing method of teaching; teaching style	5			•	•		•	•	•
Understanding content enough to develop infographic	5	•	•	•		•			•
Following steps/process/knowing how to develop an infographic	5	•	•				•	•	•
Resistant/hesitant to change	5	•			•		•	•	•
Moving away from lecture	3					•		•	•
Instructor attitude/culture of post-secondary education	2	•						•	
Instructor personal bias/preferences/teach way they want to learn	2	•						•	
Harder than normal instruction	2					•	•		
Challenge to teaching abilities	2	•			•				
Challenging to develop lesson in a way that makes sense	1							•	
Challenges perceptions about current teaching	1	•							
Instructor knowledge of subject	1						•		
Perception that infographics might be childish	1								•

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Table 62, (continued)

Factors Influencing Infographic Use – Cohort Perspective

		Participant Comments							
Factors perceived to influence use of infographics	#	A	B	D	F	J	L	N	T
Teacher-specific factors (continued)									
Familiarity with infographics: knowing how to use									
Understanding content enough to develop infographic	5	•	•	•		•			•
Following steps/process/knowing how to develop an infographic	5	•	•				•	•	•
Instructor understanding of infographics	2	•			•				
Difficulty determining best fit in particular class	2	•			•				
May not see benefit/value	2		•		•				
Concept unfamiliar to teachers, limited experience with	1	•							
Other									
Teacher adoption	1								•
Costs associated with materials for infographics	1			•					
Learner-specific factors									
Learning style/Learner types	7	•	•	•		•	•	•	•
Understanding content enough to develop infographic	5	•	•	•		•			•
Following steps/process/knowing how to develop an infographic	5	•	•				•	•	•
Resistance from learners (general)	4				•	•	•		•
Selecting/coming up with a topic	4	•					•	•	•
Learners unfamiliar with infographics	3		•	•			•		
Visual impairments, disabilities, ADA	3	•		•					•
Selecting and using the right data for infographic	2		•				•		
Learners may not grasp concept as easily	1		•						
Student population, types of students	1								•
Additional stressor	1						•		
Assessment-specific factors									
Factors associated with grading (general)	8	•	•	•	•	•	•	•	•
Concerns about rubric for grading	3	•		•	•				
Instructor interpreting student visuals	2					•		•	
How to grade fairly	2		•						•
Wide-open on how to assess; subjectivity of grading	2			•			•		
Placing too much emphasis	1						•		
How to grade art	1								•
Grader bias/preferences	1	•							
Curriculum/Program-related factors									
Curriculum/program restrictions, common courses, common assessment; academic freedom	4					•	•	•	•
Differences by discipline/class type, assignment type	3		•			•			•
Difficulty determining best fit in particular class	2	•				•			

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Skill-related factors influencing infographics use. Participants identified four (4) skill-related factors influenced the use of infographics. All of the participants thought that artistic/drawing skills and abilities would influence the decision to use infographics in post-secondary education. It should be noted that this study utilized a sketch-based approach therefore the comments by participants are based upon utilizing drawing skills to develop an infographic. The majority of participants (7 of 8) identified skills and abilities related to the visualization of ideas and concepts as being considerable factors influencing the use of infographics. The ability to graphically design, layout, and organize visual layouts and creative ability were also identified as influencing factors

Teacher-specific factors influencing infographic use. The 23 teacher-specific factors influencing infographic use identified in Table 62 are divided into three (3) sub-categories. These include (1) time and effort, (2) teacher attitudes and abilities, and (3) teacher familiarity with infographics: knowing how to use infographics.

Time and effort concepts include the learning curve, extra work and time factors involved with infographics (8 of 8 participants) and time away from other content (Adam, Frank, Jerry, Tyler). Adam, Tyler, and Becky describe some of the extra work and time implications. Adam said, "We are under a certain amount of time for certain topics and, you know, so we would have to crunch something else down to include development of infographics." Tyler added, "You're going to hear that from a lot of faculty, I don't want to waste time on teaching people how to draw stick figures whenever I can't get through my content to begin with." Becky commented that adding infographics into the curriculum "depends on how much other material you're already giving them."

Teacher attitudes and abilities were referenced by all participants and include a variety of common factors including:

- teacher not open to trying something new (Becky, Diane, Frank, Jerry, Natalie, Tyler),

- resistance to changing teaching style/method (Diane, Frank, Lisa, Natalie, Tyler),

- understanding content enough to develop an infographic (Adam, Becky, Diane, Jerry, Tyler),

- teacher resistance/hesitance to change in general (Frank, Lisa, Natalie, Tyler),

- moving away from lecture-based approaches (Jerry, Natalie, Tyler),

- and knowing how to develop an infographic (Adam, Becky, Lisa, Natalie, Tyler).

Most of the participants indicated that an instructor's resistance to changing the way they taught along with the extra time needed to incorporate infographics as the biggest challenges facing use of infographics in post-secondary education. Overall resistance to change, external pressures involving curriculum decisions, and instructor attitude and institutional culture were also identified as challenges. Other factors influencing the use of infographics in post-secondary education include the cost to provide materials for an infographic activity, the teaching style impacts, instructional abilities, and the student population.

Many of the participants thought that an overall resistance to change or a faculty resistant to changing or altering teaching approaches would influence the use of infographics in post-secondary education. Natalie suggested that one of the primary

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factors influencing the use of infographics in post-secondary education was an overall resistance to change by the faculty. She stated, "I think the most, probably the disadvantages will be with the faculty, the teachers because I think with teachers it is hard to change." She also thought that the overall "attitudes and the culture" of post-secondary education would negatively influence the use of new, alternative teaching approaches. Adam thought that instructor attitude about changing approaches would influence the use of infographics adding, "people are often hesitant to change" referring to instructor attitudes about a new type of assignment such as an infographic assignment. Natalie continued,

> I just think sometimes instructors when they are afraid of change they kind of go well we can't do that, we've never done it that way, it will never work. Well, I think that that attitude's got to go away, it's just got to go away.

Lisa contributes a similar thought adding that students might also be resistant to changing approaches, she said,

> Sometimes there is, just in general, with all of us, there's a resistance to new things sometimes cause we're so used to doing what we do and I just wonder with our culture of our students, would they be resistant to learn something like that and use it or would they not.

Lisa added that the potential resistance to a new instructional approach might not by unique to an infographic assignment.

A common theme identified by participants involved the changing of teaching approach and the reluctance and resistance associated with altering teaching practices.

Lisa offered,

Yeah, I think some teachers might be resistant. I think cause a lot of us get into

our same old routine and we've already got our courses kind of, it would almost

be like developing a new, you know, a new method, or a new way of, of teaching

in a way. I think some teachers might be open to it, some may not be so maybe

just whether or not they're open to, to the new ideas.

Tyler added,

The sage on the stage wouldn't want to do something like that, so, but you know,

you're you're syllabus would look like, you know what do you need for the

course, textbook, paper, pencil, crayons, colored pencils, that kind of thing would

look weird you know, but it's fine, it's and it works,I just think that one might be,

I don't know if it goes there, but that might be a stumbling block.

Natalie suggested that teachers should try new approaches in an effort to benefit

students. She said,

I think we just have, I try not to ever be afraid to say, you know, maybe my way is

not the best way, maybe I need to rethink this, and you know like I, I have one

exam and it's the final all my other work is like projects things because I saw the

trend in the professional standards boards and what they're going to and so I just

went with it so I think if we could just get people to see that the long-term can do,

how we can, you know, change, I think we might have some students who

typically may not have been successful, they might be successful in the college

experience.

Natalie added,

You know your field but your students coming in do not, so you need to meet

them there. And I think that sometimes I think when we test the instructors and

they have to change their methods, it makes them remember that a little bit, out of

their comfort zone. I mean, I think that we need to be shook up a little bit.

Frank offered,

Because it's new and going to be difficult on the front end because you know, you

do have to learn some things, learn the concepts, you've got to come at it in ways

that are maybe different from what you're currently doing, and, and I think you

know, just to be blunt about it, I think some people think, well, my job's hard

enough as it is, or I'm set in my ways, or I like what I'm doing, whatever, you

know, spin they want to put on it, it's just, you know, it might be seen as, you

know, too much trouble, or, if it ain't broke don't fix it, you know, whatever, you

know, I'm sure there's a dozen clichés we can throw in there or excuses or

whatever, but I think that's what it would come down to, so, good luck with it, I

guess [laughs].

Natalie suggested that the challenges associated with changing teaching

approaches may contribute to the stability of the lecture-focused classroom. She

reflected, "I think that's why a lot of times we are afraid to teach away from lecture

because it's kind of hard to screw it up, I mean, you know what I mean?"

Learner-specific factors influencing infographic use. Participants identified 11

learner-specific factors associated with using infographics in post-secondary education.

The most common concept mentioned involved the appeal of infographics to different learning styles and learner types.

Lisa described how infographics can appeal to different learning styles stating,

> I tell you what, I know I keep talking about the learning styles but I, I think the, the learning styles definitely fit with all of this [infographics], I mean, cause everybody is different and everybody learns differently." Lisa added that using an assignment like infographics gives students options. She said, "that [the infographics assignment] might cover more styles of learning you know with, you know some people may not want to write a paper, they may not want to do a speech, or they may not.

Natalie added,

> I think [infographics] speaks to different types of learners so you are going to meet the different types of learners even if they are just an auditory learner, you know, they are going to get it, because it will allow them to put their thoughts down.

Frank commented on how infographics could benefit visual learners stating,

> I think by in large, students would see it as something different, something fun, and we certainly have a lot of students who would describe themselves as visual learners and I think sometimes they describe themselves that way so that as an excuse as why they can't handle writing, in particular but I'm a visual person, I can't do that. I think students that do think of themselves that way will certainly jump on this as an opportunity to do something that makes them feel more comfortable and fits with their strengths as students maybe.

Diane thought that the infographics assignment met the needs of a more visual learner in our classrooms stating, "I think using that approach [infographics] appeals to really visual learners that we have today, people who have grown up with more visual-based learning experience."

Adam reflected on how using infographics provides learners with a different way to receive information. He said,

> It makes you think about how you could utilize things and convey things to a, to different learning styles because everybody's got different learning styles so this is just another avenue on how you can teach individuals especially visual learners, pathway learners people that learn by pathways, that's always a good thing.

Lisa suggested that an infographic assignment might help teachers reach students in a way that augments current instructional approaches. She said,

> I like to teach though in a way that meets all needs of the students and all different types of learners so this would be you know, a supplement to that, as another way, like I said for maybe some of the people who are more visual you know, the more creative, artistic people, they might appreciate an assignment like this infograph.

Other student-related factors identified by participants include:

- understanding content enough to develop an infographic (Adam, Becky, Diane, Jerry, Tyler);
- knowing how to develop an infographic/following a process (Adam, Becky, Lisa, Natalie, Tyler);
- general resistance from learners (Frank, Jerry, Lisa, Tyler);
- students unfamiliar with concepts of infographics (Becky, Diane, Lisa);

- visual impairments (Adam, Diane, Tyler);

- and student population considerations (Tyler).

Assessment-specific factors influencing infographics use. Participants identified

eight (8) assessment-specific factors influencing infographics use (Table 62).

Assessment-specific factors and issues surrounding the use of infographics as assessment

are also included in the *Assessing with Infographics* section that follows. It should be

noted that the assessment-specific factors are included here to identify factors identified

by participants that might influence the use of infographics in post-secondary education.

Findings related to the use of infographics as assessment are included in subsequent

sections. All participants identified some grading-related factors. These factors include:

- general grading concerns (8 of 8 participants);

- concerns about a rubric for grading infographics (Adam, Diane, Frank);

- instructor interpreting the student visuals (Jerry, Natalie);

- how to grade an infographic fairly (Becky, Tyler);

- and subjectivity in grading an infographic (Diane, Jerry).

Curriculum/program-related factors influencing infographics use. Participants

identified three (3) factors that might influence a decision to utilize infographics in post-

secondary education. Among these are curriculum and/or program restrictions such as use

of common course content, common pedagogical practices, and common assessment

practices (Frank, Lisa, Natalie, Tyler); content restrictions imposed by educational

initiatives, practices, policies (Natalie), academic freedom influences (Frank); and

differences attributed by differences in subject area/discipline, type of course, type of

class, and type of assignment (Becky, Frank, Tyler).

Infographic uses - cohort. Participants identified twenty-one (21) different uses

for infographics in post-secondary education. The sketched infographic in Figure 42

depicts uses provided by the participants. The size of the spheres in the infographic

provides additional information about the emphasis the topic received from participants.
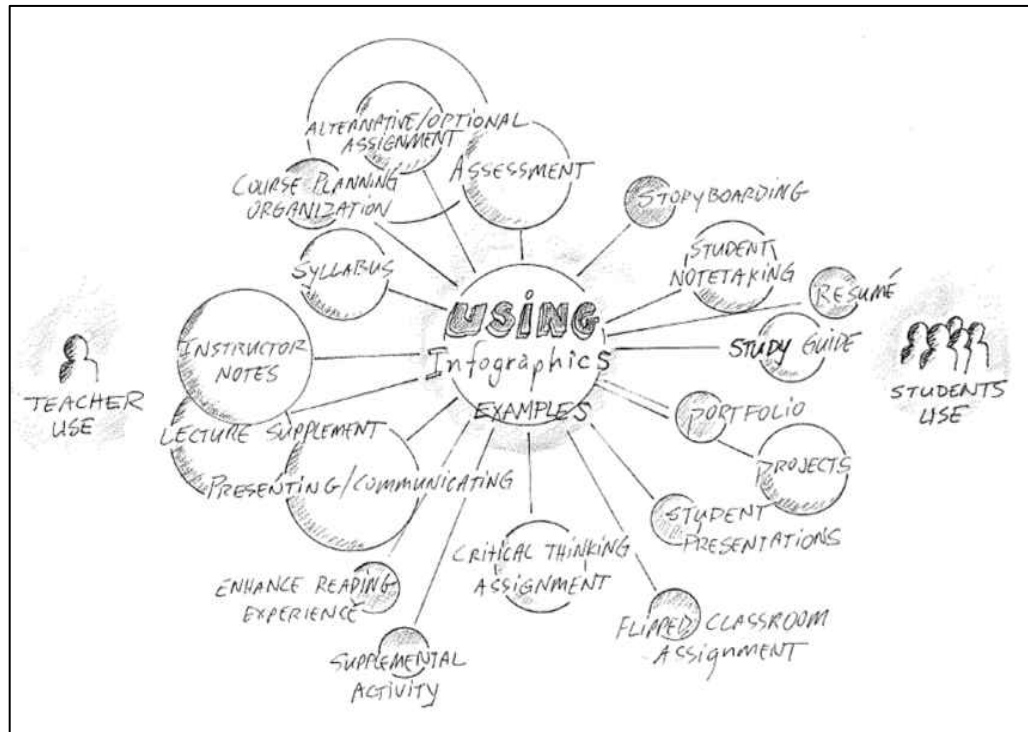
Figure 42. Using infographics in the post-secondary educational context – cohort
perspective. The infographic depicts both teacher and student uses for infographics.
Teacher uses are presented on the left side of the figure. Student uses are presented on
the right side of the figure. The sphere sizes are representative of the number of
comments made by participants related to infographics uses. The larger the sphere, the
more comments.

A complete listing of the infographic usage examples provided by participants is

included in Table 63. I organized the table to correspond to four categories including

instructor use, student use, assignment-related, and other uses.

Table 63

Uses for Infographics – Cohort Perspective

		Participant Comments							
Using infographics in Post-Secondary Education	#	A	B	D	F	J	L	N	T
Instructor Use									
Instructor notes, presenting, communicating information; lecture supplement	7	•	•		•	•	•	•	•
Assessment	5		•	•	•			•	•
Syllabus	2		•					•	
Course planning, organization, outline, prep	2		•		•				
Student Use									
Student notetaking	3			•				•	•
Storyboarding	1				•				
Study guide/study strategy	2						•		•
Assignment-Related Use									
Alternative/optional assignment/supplemental activity	4	•		•	•		•		
Projects	3		•	•			•		
Critical thinking assignment	3		•		•		•		
Enhance the reading experience	1							•	
Flipped classroom assignment	1				•				
Portfolio	1							•	
Design practice	1		•						
Conceptualize a topic	1								•
Student presentations	1	•							
Resume	1							•	
Other Uses									
Student recruitment	2		•					•	
Administrative communication	1	•							
Undecided about use	3			•				•	•

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Instructor uses for infographics. Participants mentioned four potential instructor uses for infographics. These uses include using infographics for presenting and communicating information to students, assessing learning with infographics, using infographics on the syllabus, and using infographics to assist in course planning.

The most common of these is the use of infographics for presenting and communicating information to students. This grouping includes instructor review,

instructor notes, lecture notes/guides, class presentations and as a way to improve a lecture. The following list reveals participant comments related to instructional uses.

- Instructor review of material, deeper insight into material (Lisa, Frank)

- Instructor notes, lecture notes (Jerry, Lisa)

- To introduce content, communicate ideas to students (Natalie, Frank, Adam, Tyler, Lisa)

- As a lecture guide, study tips (Natalie, Tyler)

- Use infographic instead of Powerpoint to present information, something different (Natalie, Jerry, Becky)

- Way to improve lecture (Frank)

Infographics as assessment. Instructor use of infographics as assessment was mentioned by five of the participants. These five participants mentioned assessment during an overall discussion about the use of infographics. The following are the assessment-specific uses described by the participants.

- Using infographics as formative assessment (Tyler, Diane)

- Eventually using infographics for summative assessment (Tyler)

- Incorporating infographics into a quiz (Natalie)

- As an excellent form of assessment (Diane)

- Infographics as an alternative form of assessment (Frank)

- Assessing the technical aspects and content of an infographic (Becky)

  Diane describes using infographics for assessing student learning,

  I think it's excellent, I'm not sure I understand all the ways it can be used best but

  I'm definitely, I'm sure that it can be used, at various degrees. Some people will

use it you know, different instructors will use it in different ways, but yeah, I

think it's an excellent form of assessment in our discipline and in post-secondary

education in general.

Diane continues,

It's better and more comprehensive than the, like the quick, classroom

assessments that I do. There are some similarities in the ones that are visual, I

mean, we do lots of drawing or manipulating a figure that already exists in an

incomplete form, the differences again are just in the amount of liberty the student

has to be creative and to synthesize on their own. So I like the infographic better.

Yeah, I definitely want to do that. I may use some of my original activities maybe

as a starting point, or some version of them as a starting point and have

developing an infographic as a cumulative you know, and end point of a topic that

we revisit in several ways. I still may use them for simpler concepts, creating an

infographic even just in class and maybe revising, you know, revising it.

Tyler and Diane were the only participants to talk about the formative and

summative aspects of infographics as assessment. Natalie and Frank describe using

infographics as assessment in their classes and Becky elaborated on the grading aspects

regarding separating the technical and content aspects of an infographic. These and other

specific responses to questions related to using infographics as assessment are included in

the Infographics as Assessment section.

Infographics and the syllabus. Becky and Natalie mentioned the use of an

infographics-based syllabus in their classes. Becky said, "I like the idea of doing it for the

syllabus, I really want to do that for every one of my classes now." Natalie describes how

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using an infographic syllabus could be helpful in introducing the concept of an infographic to students.

> You know you may just try to introduce it by using your syllabus, do something that's not an assignment for them but expose them to it first before you actually get them into an assignment or use it in your lecture instead of a PowerPoint, and then bring it in, you know, because, then they'll be like, oh yeah, that's what you're, ok, I saw, I've seen that, you know. – Natalie

Infographics and course planning. Frank talked a great deal about how infographics might be used by an instructor to help them plan their course(s).

> If I do nothing else with infographics, I'm planning on sort of doing it for my own purposes and some of it I will be able to bring to the classroom as a way of demonstrating concepts but some of it just be so I'm clear on what I'm doing, why I'm doing it, so very valuable for that reason.

Frank also describes why he thought an infographic might be beneficial for an instructor to use in their course planning.

> I think this sort of thing [an infographic] helps to, to tap into that sort of thinking, that conceptual… there's a word for it, you may be able to help me with it, it's almost like thinking, you know, in 3D form, about a course rather than a course schedule, and you know thinking very two-dimensionally about it, so, it was helping me to think three-dimensionally about online learning and of course I realized you could probably apply that to anything, any course you teach, any discipline, any whatever, particular class, that you want to be able to think about it from different angles, and to think about it in 3D form, I think you can, and I

think what I mean be that in terms of any course to see how everything connects,

everything flows, everything builds, how concepts you know, work back on

themselves, you know, that idea or you know, and so I think infographics would

be a great way to plan for that but also to communicate that to the students what

we're trying to do here.

Frank elaborated on how he thought he might use infographics to help plan his

courses.

At the front end of it, and where infographics might be a value is to help

instructors to plan out their course and understand, okay, what are the most

important concepts and what do I want to get across and maybe even see things

that, I'll just say it, I'm thinking about this summer, kind of doing my own little

infographic for my, for my classes, particularly for my online classes. I think it

will help me to see connections better, see things better, so that I can see what is

most important, and how best to handle those things and things that are less

important, and then I'm guessing they're even some things, that I, once I really

look at it, I'll think, they don't need to be there, you know, I don't need this. This

is cluttering things up this is you know, we're spending too much time on

something that doesn't really matter in the big picture literally, that I, you know,

am thinking about putting together.

Student uses for infographics. Participants identified six (6) student uses for

infographics in the post-secondary classroom. The listing of student use infographics is

included in Table 63. Among these were infographics for notetaking (Natalie and Tyler),

using infographics as projects (Becky, Diane, Lisa), infographics as a critical thinking

assignment (Becky, Frank, Lisa), using infographics as an alternative or optional assignment (Diane, Frank, Lisa), using infographics as a study guide or study strategy (Lisa, Tyler) and using infographics for storyboarding a process/concept (Frank).

Student notetaking. Natalie and Tyler both indicated that students could use infographics to assist in the notetaking process. Natalie described using student-created infographic notes to help her assess the progress of students. "I always have lecture along with my textbooks so just have them take notes and then that way I can see if they're getting it." She added, "Instead of having them, just testing them over that material, cause I always give like quizzes, things throughout just to kind of keep them on track, is to have them take notes like this and then present them to me in a blog area or somewhere and kind of talk about what they took from it."

Natalie and Tyler shared their thoughts about how infographics might be utilized by students for notetaking.

> I think the idea about notetaking is really important because I don't think a lot of
> kids know how to take notes." She added, "But if you made notetaking kind of
> fun for them, where you know, almost make it where at the end then you review
> and go back over where they share their infomatics they are going to pay attention
> [laughs]. They are going to pay attention. -Natalie

Tyler suggested,

> I would also take it and use it as a form of, of a graphic organizer and, and
> notetaking so I would want my students to be able to use this in their notetaking,
> for notetaking skills, I'm kind of big on that, whenever I go, whenever I'm talking

in my courses about taking notes. So that's probably another, another avenue I would approach it.

Study guide/study strategy. Lisa and Tyler both thought that infographics could be used to assist students with studying. Tyler said, "I think it would be a great way to study, and try to, try to certain topics, being able to, to do that, to study with." Similarly Lisa added,

> Give them a study guide if, if I can, or some sort of outline or something about what to study so if they could have a visual you know of that or how to connect you know certain concepts or things to help it, to help them learn the material definitely for that.

Assignment-related uses for infographics. Participants identified ten (10) assignment-related uses for infographics. The full listing of the assignment-related uses is listed in Table 62. Using infographics as an alternative, optional, and/or supplemental was mentioned by Adam, Diane, Frank, and Lisa. Projects (Becky, Diane, Lisa) and critical thinking assignments (Becky, Frank, Lisa) were also identified. Several items were mentioned by at least one of the participants. These items include using infographics to enhance the reading experience (Natalie); as a flipped classroom assignment (Diane); as a portfolio assignment (Natalie); for design practice (Becky: to conceptualize a topic (Tyler); for student presentations (Adam); and using infographics for student resumes (Natalie).

Other uses for infographics. Student recruitment (Becky, Natalie) and administrative communication (Adam) were other uses mentioned for infographics. Diane, Natalie, and Tyler also indicated that they were undecided about how to use

infographics even though each had contributed to several uses for infographics in post-secondary education. Diane stated, "I'm not sure I understand all the ways it can be used best but I'm definitely, I'm sure that it can be used, at various degrees. Some people will use it you know, different instructors will use it in different ways." Natalie added,

I'm going to really incorporate it in there, but I haven't thought that through yet

but I'm going to really, cause I actually have them come to me a couple of times

so I'm gonna to try and find a way to implement it for them.

Similarly Tyler suggested, "I think it could be used, I think, I think it has a place, where? I don't particularly know yet." Further, Tyler said,

It would be hard for me to come up with a list of here's what I'm going to do,

here's what I'm going to do, here's where I'm going to use it, but when I go

through a course now, it's always going to be kind of one of those things where

hey I think I could use this here.

Infographics and learning – cohort. Participants shared numerous thoughts related to infographics and the perceived impact of infographics to learning. Figure 43 provides an infographic overview of the participant thoughts about how infographics influence learning.

Figure 43. Infographics and learning – cohort perspective. The infographic depicts various learning impacts that participants associated with infographics.

Participants described 31 specific learning impacts associated with infographics in post-secondary education. These learning impacts are included in Table 64. Eight (8) major categories emerged from an analysis of the comments. These major categories are shaded in Table 64 to provide emphasis.

Table 64

Infographics and Learning – Cohort Perspective

Thoughts about infographics' impact to learning	#	A	B	D	F	J	L	N	T
Better, more in-depth understanding; perspective	8	•	•	•	•	•	•	•	•
Infographics as a teaching activity (teach to learn, learn to teach); being able to communicate understanding	5		•		•	•	•		•
Encourages thought, deeper thought; rethinking	4		•		•			•	•
Valuable for students to go through process; finding a way to learn	3			•			•	•	
More meaningful learning	1				•				
Useful tool	2		•				•		
Promotes critical thought, higher-level thinking, critical analysis	8	•	•	•	•	•	•	•	•
Big picture thinking	3			•	•	•			
Find connections in content, conceptualize topic, identify patterns	5		•	•	•	•			•
Reinforces learning; retention and recall; memory/study aid	6	•	•		•	•	•		•
Faster way to learn	2	•	•						
Great way to learn, helpful;	3		•	•				•	
Students would love this	1							•	
Impacts learning	1					•			
Promotes organizational skills	1	•							
Offset limited reading skills	1							•	
Promotes visualization skills; visually communicate understanding	6		•	•	•	•	•		•
Provides way to visualize learning	2			•	•				
Requires accurate information/information checking/vetting/research skills	4	•	•				•	•	
Something different, another form of learning, open our minds to new ways; cutting edge way to make class better; way to challenge students	5			•	•		•	•	•
Fosters creativity, imagination	5		•	•	•			•	•
Opportunity for discovery; see the story develop; see learning represented; provides way to visualize learning	2			•	•				
Stimulates engagement; encourages attention; student connect with this more	5		•	•		•		•	•
Another form of learning	2	•							•
Fun factor	3					•	•	•	
Way to make classes better	2		•					•	
Encourages flexibility in learning	1							•	
Stimulates social environment conducive for learning	1			•					
Lots of information in a small area/condensing/organizing	3	•	•				•		
Helpful to teachers; – informs instruction; sensitive to learner needs	2			•	•				
Meets needs of different learning styles; learner needs; address learner anxiety	6	•		•	•		•	•	•

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Learning impacts - cohort. The concepts associated with the theme "Learning and Infographics" were analyzed and categorized into three (3) major learning impacts. Overall learning impacts, visual learning impacts, and learning environment impacts. Overall learning impacts relate to the learning outcomes associated with infographics. Visual learning impacts refers to learning impacts associated with the visualization and development process. Learning environment impacts refers to learning impacts associated with the classroom and learning environment. As depicted in Figure 44 these categories are not exclusive but interrelated and influence the learning associated with infographics. The categorization I utilize in this narrative is to provide some delineation among the different facets of learning described by the participants. The infographic in Figure 44 provides a graphical overview of the concepts contained within each categories.
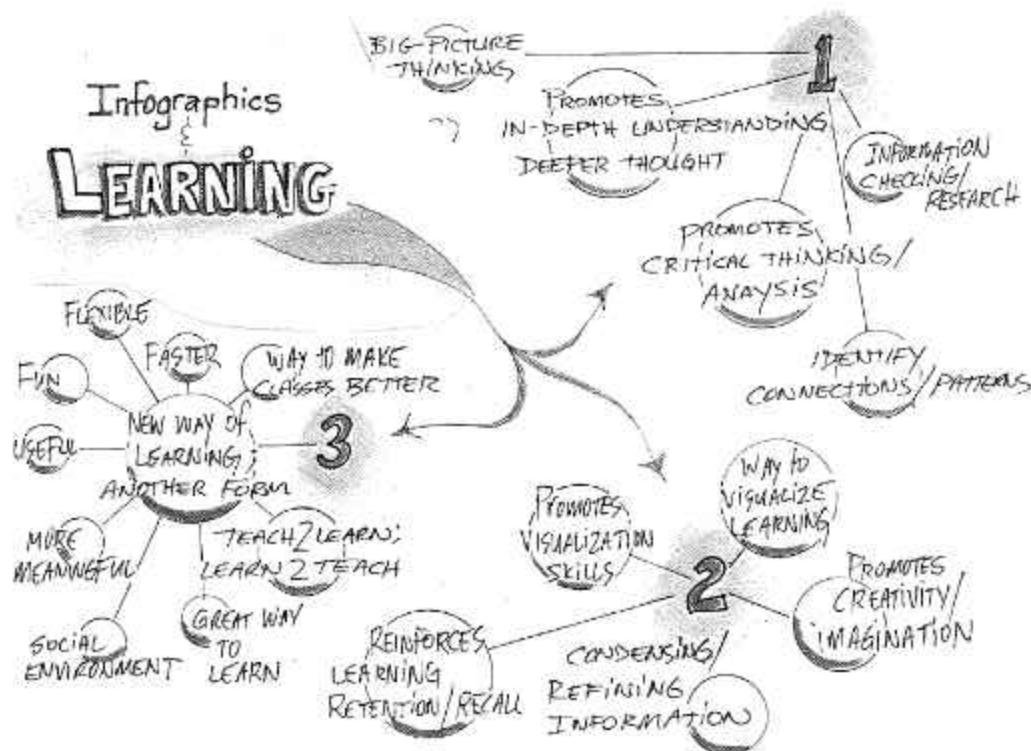
Figure 44. Learning impacts with infographics. The infographic depicts three categories of learning impacts associated with participant responses. The size of the spheres in the figure are representative of the number of comments shared by participants related to the concepts. More comments = larger sphere; fewer comments = smaller sphere.

Overall learning impacts. Overall learning impacts involves the concepts that relate more to the outcomes of the learning process when developing an infographic. Overall learning impacts include:

1. improved understanding and comprehension;

2. critical thought/critical analysis, and higher-level thinking;

3. conceptualization, identifying patterns and finding connections in content;

4. and development of research skills and vetting of information.

Visual learning impacts. Visual learning impacts are concepts associated with the learning taking place during the actual development of the infographic. Visual learning impacts include:

1. visualization skills and ability to visually communicate understanding;

2. reinforcement for learning, retention, and recall;

3. condensing and refining information;

4. and promotion of creativity and imagination.

Learning environment impacts. Learning environment impacts are concepts associated with the learning environment and learning approach associated with an infographic assignment. Learning environment impacts include:

1. providing a different and new way of learning that challenges students;

2. meeting the needs of different learning styles and learner needs;

3. improved classroom experience;

4. and the concepts of teaching to learn and learning to teach.

During the coding process these learning impacts were grouped into eight (8) categories of how participants thought that infographics impacted learning. These categories are provided in Table 64 and include:

- improved understanding/comprehension;

- critical thought/critical analysis, higher-level thinking;

- conceptualization/identifying patterns and finding connections in content;

- visualization skills/ability to visually communicate understanding;

- reinforcement for learning, retention, and recall;

- meeting the needs of different learning styles/learner needs;

- different/new way of learning/challenging students;

- and development of research skills.

The following is a summary of the learning impacts described by participants within the specific categories.

Improve understanding/comprehension. All eight participants mentioned that they thought that infographics promoted better, more-in depth understanding and comprehension. Although each of the participants contributed thoughts related to how developing and infographic improves understanding, the following excerpts from Frank, Jerry, and Tyler provide an overview of the thoughts expressed.

> You have to have a deep enough knowledge and enough critical thinking applied to it to do this at all and in the process of doing it, I think it takes you to a level or two deeper in doing it, so you know, that's two levels of learning in one assignment I mean how good, the potential is great in that way. Took me a while but I finally was able to express that. – Frank

Frank added, "I think though this gives, as I've also said before a more fully realized, three-dimensional kind of understanding of things." He elaborated, "I was having trouble sort of articulating earlier, or even just thinking through that to visualize something to the extent to where you do an infographic you've got to understand it pretty well already."

Jerry and Tyler had similar views about the importance of understanding content in order to develop an infographic. Jerry said, "You know I knew it [content for infographic] but when you see it all together it really, even for me, helps promote understanding of it." Jerry continued, "It gives me a better perspective and understanding of the subject." Jerry added, "You have to get into the subject to understand it to be able to map it out like that…you have to truly understand it to be able to do it [develop an infographic]." Similarly Tyler suggested, "You need to have a pretty in-depth understanding of the, of the content to begin to display it as an infographic." Tyler continued, "You can't do one of these things [infographic] if you don't really understand the topic."

Participants also mentioned the following learning impacts, which are related to improving understanding and comprehension.

Use of infographics as a teach-to-learn activity. Becky, Frank, Jerry, Lisa, and Tyler all mentioned this concept. They described the creation of an infographic as promoting the teaching of content to others. As students would develop an infographic they are required to communicate understanding, in essence, teaching the concept to someone else.

"It kind of is teaching them how to teach." – Becky

I think too that you're really, what you're asking students to do [pause] is to

teach... You know because they're, cause this would be for an audience and

you're communicating information, ideas, concepts, processes, whatever, to an

audience and so regardless whether it's visual or PowerPoint or presentation,

speech, whatever, you got to know what you're talking about to be able to explain

it to somebody else. – Frank

Showing you understand the meaning, you understand how to use it, you

understand it as an abstract and that's sort of what you're doing with a, an

infographic, you're breaking it down and then bringing it back a different way. -

Jerry

I mean I've always heard that you know you've learned something when you can

explain it to someone else, and so, that is a way, you know... but it's true, when

you can explain something clearly to someone else that means, that you've,

you've learned it too, and I think just being a teacher, I think we learn constantly.

- Lisa

Tyler added, "Basically you're re-teaching it, you're teaching it to someone."

Becky also characterized the process as one in which the teacher could learn from

the student's infographic. She described the situation where a teacher could evaluate the

infographic developed by students in a way to inform and modify the instruction. Becky

thought that teachers could see what students are learning and the infographic itself could

be used to evaluate teaching.

Infographics encourage deeper thought about a topic. Becky, Frank, Jerry,

Natalie, Tyler all described that infographics would require students to really think about

the subject they were representing on an infographic. Becky's topic during the infographic training was to redesign her course syllabus using an infographic format. As she went through the process of developing her infographic syllabus, she reflected on how the process made her 're-think' how she approached her syllabus. Becky said, "I did rethink everything you know, it made me rethink my, my syllabus." Natalie reflected on her infographic development experience stating, "I really had to think." Similarly, Jerry said, "It makes you think about it [infographic topic]." Natalie described how the infographic lesson required deeper levels of thinking sharing that the infographic assignment was "Something different to kind of challenge, to just to make them have to think a little deeper, that's what I like cause you can't just kind of throw this [the infographic] around." Tyler thought that the process of developing an infographic might promote student thought. "You know visualizing so maybe if it forces them to draw it kind of forces them to think for once and not just sit there and stare out into space."

Frank thought that the process of developing an infographic that would be read by someone else promoted deeper thought about the topic.

> They know that it's not just me reading it, it's other students, so you know, I think that's, anytime you can bring audience into it, you know, that encourages students to think in a deeper way so now there not just, I got to know this concept for me, or for a test, or cause of the job I'm going to get someday, it's like, you know, they have to bring other people with them and to do that you've got to know what you're talking about and be able to really communicate that knowledge, so yeah, the more I talk about this, the more I like it, you know, got to figure out how to use it.

Several participants thought that going through the infographic process was a valuable learning activity (Diane, Lisa, Natalie).

***Critical thought/critical analysis, higher-level thinking*.** All eight participants thought that developing an infographic required and promoted critical thought, critical analyses and higher-level thinking. Participants reflected that the infographic development process itself promotes critical thinking (Adam, Frank, Jerry); discussed how students need to be able to evaluate information (Becky); discussed critical thinking within the context of post-secondary education and within subject disciplines (Lisa, Diane); described how infographics require more critical thought than traditional forms of assessment (Natalie); and suggested the ability of infographics to promote higher-level thinking (Lisa).

Adam, Frank, Jerry, and Tyler thought that the infographic development process itself requires critical thinking and analysis.

> Oh yes, it would, because the whole process was critical thinking trying to figure out layout process, topic that is pertinent and important enough to put an infographic on then the information on that particular topic, that you would even, how you would branch that off to really do an infographic to start with. So yeah, definitely critical thinking. – Adam

Adam added,

> I think it is an easier way to assess critical thinking skills too, because there are several different components of critical thinking that have to go into it, for the whole step process, planning process, not just the outcome of it. – Adam

Frank and Jerry reflected that the infographic activity required critical thought. Frank said, "I do think you would have to have some level of critical thinking going on to be able to produce the infographic whatever, on whatever you're doing." Similarly, Jerry responded, "It encourages looking at little things that you might not have, you otherwise pass over but it, it encourages critical thought." Tyler suggested that the process of developing an infographic would promote thinking that could reinforce and support student learning.

> I would think that if when they start with the subject they would have to sit down and really analyze what they're trying to talk about and it would, at the very at the very minimum, it would reinforce concepts, it would reinforce that concept just a little bit better, so I think, I think it would, would help student learning. – Tyler

Becky touched on how students in her discipline are going to have to be able to evaluate information in order to select the most important or most appropriate information and that using a process to develop an infographic promotes this skill.

> They [Becky's students] have to know how to do that because my students for instance, these [infographics] are becoming very popular, I mean, so, I think they're [students] going to see that a lot in their workplaces, you know, they're going to be asked to design these, you know maybe not everybody but some will [Becky's students].

Becky added,

> They're [Becky's students] going to need to know how to, you know, cull through that information, and it may be information they know nothing about, and they're going to have to figure out what is the most important piece of information here

that I really need to, you know, focus on, and to make, you know, put in a hierarchy fashion you know, where do I start and so I think starting at a basic level like this and building up from there is going to help them through that thought process.

Lisa and Diane described the critical thinking of infographics in terms of how those skills are encouraged in post-secondary education and in the way student struggle with learning new course information within the context of the subject area. Lisa stated, "I'm all about critical thinking in my classes, I think college should change our thinking, if it doesn't what's the point in going [laughs]." Diane added,

I think that's critical thinking. I mean the thing that's really hard for my students in anatomy and physiology, is there's a ton of memorization of new language, but there's also, it's not just that either, it's really conceptual so you can't rely on memorizing words and you can't just casually think through things you know. You're memorizing, memorizing a lot of unfamiliar territory.

Natalie discussed that an infographic required different skills than that required on an objective assessment stating, "…You are not just taking in data and putting that fact down on a multiple choice thing."

Lisa reflected on how infographics might provide a way to help students achieve and exhibit 'higher-level thinking' stating,

Like memorization, or learning the material, comprehending it better, maybe too it might, now that I'm thinking about this, it might give them a better way of you know analyzing, you know analysis of stuff and analyzing it and maybe

evaluating, maybe some of that higher-level thinking that we kind of strive for, but rarely reach. - Lisa

Big picture thinking. Diane and Jerry, commented on how the infographic helped to promote what they referred to as 'big picture thinking.'

I think we talked about creating a, getting a snapshot of the student's big picture view of the concepts, you know, are they making the right connections, are they seeing the big picture? I think that's a really positive, it lets them go through a process and build up their understanding and they're much more likely to remember it and carry it with them in a meaningful way. It's kind of like storytelling. – Diane

Jerry said, "When they're designing it themselves, you know, they have to, you have to think of the big picture before you really get going." Jerry continued,

Maybe, I think the infographic gives you, rather than, you know when you lecture or even a PowerPoint or something, you're giving them specific points of information where an infographic because of the way it's designed you can see it overall and, and I think that's important because a lot of people learn the bits and pieces but they don't see the overall reason for their learning and this provides it all on one, in one area where you can look at the little pieces and get those, bits that you need to know for the test but you also get the overall, why are we doing this, what, what, what's the purpose of this instruction. – Jerry

Visualization skills and the ability to visually communicate understanding. Six of the eight participants thought that infographics promoted visualization skills and assisted in the visual communication of understanding to others. These participants

focused on how to visual present information and ideas for someone else to understand and determining the appropriate visualization forms to utilize in order to effectively communicate understanding.

> You're going to have to you know, take that information and figure out what's the best way to present it on that one sheet of paper to get your message across, you know, to help someone else to understand. – Becky

> I think in the sciences we have this idea, we know ultimately we're always refining our understanding of things, but here's an eye and this is how it you know, we're trying to just replicate it instead of be able to be more creative. And I think it's helpful for students to get a chance to put those ideas into a picture you know. - Diane

> I took a science illustration course when I was in college and I always knew it helped me to sketch things out, but that was just really eye-opening, because I noticed things that I would have never have appreciated in such detail if I wasn't trying to represent them visually. - Diane

> I think this helps to visualize that process you know, so it could be about the subject matter and showing interconnectedness of ideas but I think it can also just be a almost a visual representation of the learning process about that concept or subject potentially. – Frank

Jerry reflected on the challenge of visualizing information, "It was getting from the, I know what I want to talk about but how do I express that." He continued describing the importance of "Understanding what graphs work best for what situations." Commenting on the selection and use of the appropriate visualizations. Tyler suggested

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that if students understood the concepts of an infographic that they could communicate that knowledge in a visual format stating, "If someone felt pretty, pretty confident in how to explain something to somebody, surely they can do it in picture and infographics."

Reinforcement for learning, retention, and recall. Six of eight participants thought that the visual nature of infographics helped to reinforce and improve learning and aid in the retention and recall of information. Participant comments related to this concept include:

- process of producing and infographic may help promote remembering concepts (Lisa);

- lots of focus on memorizing content (Diane);

- visual forms may student recall concepts (Adam, Becky);

- helps student improve learning (Jerry);

- and producing infographics helps reinforce learning (Frank, Jerry).

The following comments from Adam, Becky, Jerry, Frank, and Tyler provide additional detail and insight regarding the infographic influence to learning, retention, and recall of information.

> I think it would be good because a lot of our stuff is visual anyway, and sometimes it is easier to memorize things from a visual concept than it is from a written concept so if they can you know, try to recall things maybe some of those drawings or maybe they can even write it out themselves will help them recall some different things that they had failed to remember just from seeing some of those symbols, diagrams, or charts, or flows, or whatever they were utilizing. – Adam

Becky offered that the process and actions involved in creating an infographic might also prove beneficial. She said, "Anytime you're drawing something or even if you're just writing it out you're going to remember it better than you are from selecting a, b, c, or d." Jerry had a similar suggestion stating "The bottom line is understanding your subject so you're, whether you're drawing it out or you're explaining it or whatever, I think this helps you understand it longer, it keeps it in, you know, by, by doing this." Frank remarked that the process of developing an infographic would provide a means for students to…

> See their own learning represented, you know, so you can kind of see that, it's helping them learn but then they can see what they've learned in the process all on the page, it's a, I mean, it's like reinforcement to me, you know, deepening.

Tyler described the reinforcement of learning occurring with infographic development.

> I would think that if when they start with the subject they would have to sit down and really analyze what they're trying to talk about and it would, at the very, at the very minimum, it would reinforce concepts, it would reinforce that concept just a little bit better, so I think, I think it would, would help student learning."

Participants also thought that infographics were an impactful (Frank), faster (Adam, Becky), and helpful way to learn (Becky, Diane, Natalie) that students would love (Natalie). Some participants thought that infographics promote organizational skills (Adam) and may offset limitations associated with reading skills (Natalie).

Meeting the needs of different learning styles/learner needs. Six of eight participants indicated in some way that infographics may meet the needs of different

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learners, accommodating different learning styles, and giving learning options for students. Participants describe that infographics might provide options for learners (Diane, Lisa, Natalie), create new learning pathways (Adam); help to balance the grade by providing different types of assignments (Lisa), may alleviate test anxiety (Tyler), and may allow individual learner strengths to come out (Frank).

> Yeah, because it makes you think about how you could utilize things and convey things to different learning styles because everybody's got different learning styles so this is just another avenue on how you can teach individuals especially visual learners, pathway learners people that learn by pathways, that's always a good thing. – Adam

Diane reflected on the new generation of students who are accustomed to visual learning stating, "Yes, I think, I think using that approach appeals to really visual learners that we have today, people who have grown up with more visual-based learning experience."

Frank described how visual learners might gravitate toward an infographics activity.

> But I think by in large students would see it as something different, something fun, and we certainly have a lot of students who would describe themselves as visual learners and I think sometimes they describe themselves that way so that as an excuse as why they can't handle writing, in particular. I'm a visual person, I can't do that, but I think students that do think of themselves that way will certainly jump on this as an opportunity to do something that makes them feel more comfortable and fits with their strengths as students.

Similarly, Lisa described how different learning styles might be accommodated with an infographics activity. She said, "I tell you what, I know I keep talking about the learning styles but I, I think the, the learning styles definitely fit with all of this, I mean, cause everybody is different and everybody learns differently." Lisa continued,

I like to teach though in a way that meets all needs of the students and all different types of learners so this would be you know, a supplement to that, as another way, like I said for maybe some of the people who are more visual, you know, the more creative, artistic people, they might appreciate an assignment like this infograph.

Natalie also recognized the connection of an infographics activity to different learners and learning styles,

I think [infographics] speaks to different types of learners, so you are going to meet the different types of learners even if they are just an auditory learner, you know, they are going to get it, because it will allow them to put their thoughts down.

Natalie added,

There are a lot of kids that maybe their brains work a little differently, I can see it really making the learning where you could actually, they could be challenged to see where they really are at. So, and not so intimidated by it.

Conceptualization/identifying patterns and finding connections in content. Finding connections in content, being able to conceptualize a topic, and identifying patterns within content were identified as learning benefits associated with infographics (Becky, Diane, Frank, Jerry, Tyler).

Diane, Frank and Jerry's comments reflect the overall contributions from participants related to this category. They elaborate on how developing infographics may help students bring together seemingly unrelated, disjointed concepts by exploring how these concepts interconnect and build revealing the overall purpose of instruction and doing so in a way that might not be possible with other forms of learning.

I think about phrases like critical thinking but what I don't know [laughs], I think what it, what's the word I'm trying to use, it causes students to see connections and to integrate seemingly unrelated topics. It's like writing a story, instead of memorizing a list of facts, so I think an infographic, in the sciences is particularly valuable because they get to create a picture or tell a story about things that seemed [emphasis] unrelated previously. – Diane

Diane continued,

I think it would cause them to revisit a greater array of information and put it together in one unified unit, as opposed to seeing them as a bunch of disjointed things they have to memorize. That's what I think would be really useful in a science course like what I teach. I have study guides with all these questions that I think cause them to build the story, but I find that a lot of times they don't do that, they just want to make sure they can answer each question, and they don't even see that I'm trying to put things together by this series of questions, but I think if they had to make an image there would be no choice but to see some connections.

- Diane

Frank described the benefits associated with conceptualization and identifying connections within content.

That it's really about your content and the concepts and it's a way of thinking about them, thinking through them, again, getting to a level of conceptualization and if can get students to take content and start to create with it, conceptualize it and apply it or whatever, then that's deeper level learning that we all want to get to and so, so yeah, the potential is there to do that in ways that you know, you might not be able to do otherwise, and you know, in a fun and different way.

Frank added,

But that seems to be the biggest benefit that I'm seeing so far, is that students can see interconnectedness of ideas and flow of ideas even, or concepts and how they can build on one another, and so if students can, I mean, for me, that really just taps into the basic idea of learning, to go from what you don't, what you already know to what you don't know, and nothing is sort of brand new information or brand new concepts, or brand new techniques, they have to build off previous ones you know, to really learn something.

Frank described an issue he had with getting the infographic content condensed to a single page and reflected on how that process encouraged how the concepts being studied connected.

I understand now the value in that, better understand it because if I had broken it up, the concepts that I was putting, trying to put in that one infographic, if I break it up, then I'm missing that interconnectedness and seeing, you know, seeing it you know, side to side, front to back, all of it together and so I think that's the value for students as well, that they will be able to see that, and need to see that.

Frank suggested that the concepts associated with infographics and the learning associated with discovering conncetions within content are contributors to an effective class.

I think any good class should, students ought to be able to pick up on connections but if you're just like, we're going to cover this, and then we're going to cover this and there doesn't seem to be any connection with each thing, I don't think that's a very good class, if that's the approach you have, I think there has to be a, you know, where students see how it's all connected in one way or another, and this, you know, you've got it all right there visually.

Jerry also mentioned how the infographic promoted an overall view of how a course or topic fit together.

I think the infographic gives you, rather than, you know when you lecture or even a PowerPoint or something, you're giving them specific points of information where an infographic because of the way it's designed you can see it overall and, and I think that's important because a lot of people learn the bits and pieces but they don't see the overall reason for their learning and this provides it all on one, in one area where you can look at the little pieces and get those bits that you need to know for the test but you also get the overall, why are we doing this, what, what, what's the purpose of, of, this instruction.

Different/new way of learning/challenging students. Five of the eight participants suggested that infographics are a new and different form of learning. The participants commented on how an infographics activity opens our minds to new ways of

learning and gives us new ways to challenge students while at the same time making our

classes better.

> I hope it's not coming across that I'm trying to like, pump this up to, to make you
>
> feel good or anything, but I really think it could be, I guess I'm going to go ahead
>
> and use the word, I don't think it's overstating it, to be revolutionary, I mean for,
>
> for some instructors or disciplines, I think this could be, you know, something that
>
> they might ought to be doing instead of what they're already doing, the potential
>
> is there for it be, to really revolutionize what, how they come after concepts. –
>
> Frank

Frank continued to describe how infographics provided a new way for students to

learn. He said,

> That it's really about your content and the concepts and it's a way of thinking
>
> about them, thinking through them, again, getting to a level of conceptualization
>
> and if can get students to take content and start to create with it, conceptualize it
>
> and apply it or whatever, then that's deeper level learning that we all want to get
>
> to and so, so yeah, the potential is there to do that in ways that you know, you
>
> might not be able to do otherwise and you know, in a fun and different way.

Natalie suggested that infographics would be something new for students stating,

"This might be something to try and go to something different for them to see." Natalie

added,

> It's just another way for us to introduce content and then to also receive content
>
> from students, something different to kind of challenge, to just to make them have

to think a little deeper, that's what I like cause you can't just kind of throw this around.

Lisa commented similarly describing a new and different approach for teaching and learning.

I think it [infographics] opens our minds to other ways of, of [pause] teaching and student learning, and it's another way of assessing grades, another way of measuring learning, [pause] and another way of communicating what they're, what they're learning in class." – Lisa

Lisa expands on another benefit associated with different learning styles.

I think it might, like I said a while ago, there's all different types of learning and different learners and of course here, we have all different types of students, so I think the infograph would definitely help, well it could help all types of learners I guess, but I started to say the ones who are more visual learners and maybe those that aren't, it might open their mind, you know to see something in a different way.

As subsets within this category, participants commented on how infographics may influence creativity and imagination (Becky, Diane, Frank, Natalie, Tyler); how infographics may stimulate engagement, encourage student attention, and provide pathways for students to connect to the lesson content (Becky, Diane, Jerry, Natalie, Tyler); and how infographics may facilitate and emphasize opportunities for discovery during the learning process (Diane, Frank).

Creativity. Five participants thought that infographics fostered creativity and imagination. Each of the participants touched on the infographic influences to creativity

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in different ways. Natalie emphasized that she wants hers students to be more creative because that's what employers want stating "See I want them to try and be a little more creative because I think that's what employers are looking for now." She also commented that the way the infographics learning environment is set up can influence creativity "I think you allowed us a lot of different ways to express ourselves." She was elaborating on how I utilized training and support materials to give the participants options in designing and developing their infographics. She added, "I think you really promoted the creativity." Becky discussed how infographics enable her students to have more design practice and added, "You know, you're going to get something different from every student."

Diane commented that she thought it was helpful for students to have opportunities to be creative and that the process of developing an infographic provides those opportunities.

I think in the sciences we have this idea, we know ultimately we're always refining our understanding of things, but here's an eye and this is how it you know, we're trying to just replicate it instead of be able to be more creative. And I think it's, it's helpful for students to get a chance to put those ideas into a picture you know.

Frank commented that our ability to be visually creative may be suppressed, as we are educated and that infographics may bring out innate creativity.

It kind of took us, we were all talking about you know, being in kindergarten and working I mean, which is good because we, we start out as so visually creative and that is encouraged and then it gets sort of beat out of us along the way and it

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doesn't have to be that way. So it sort of, you know, tapped into something that

we all had at that point.

Adam suggested that students today seems to lack imagination adding that an

infographic assignment may encourage student thought and visualization. He offered,

I don't know if students anymore have an imagination and I don't know if it's a

product of what but just seems to me when I was at the high school and now here,

when you ask your students to think about something, to visualize it, they just

have a, I swear it's just a blank, their mind is just black and they don't, they can't

think of, you know visualizing so maybe if it forces them to draw it kind of forces

them to think for once and not just sit there and stare out into space.

Engagement. Several of the participants commented on how infographics could

benefit learner engagement by encouraging student attention, and providing ways for

students to connect with the content.

I didn't even think about this [using visualization], but one of the other reasons I

started doing things like this is because it forces them not to be so passive and the

people who are just like, checked out and expecting to receive instead of process

you know, you see that immediately, they realize [gasp] I'm being called on to

interact with this information instead of sit back and they think, I'll study it later

at home but they don't. I mean, if they, I think getting them to start interacting

with it in class helps them see what they're not getting. We didn't mention it

earlier but just that engagement, we hear that all the time, but it certainly forces,

forces may not be a pretty word to use, but it stimulates engagement that wouldn't

happen in a traditional lecture format at all. - Diane

Jerry commented on how the infographic assignment would encourage interaction and engagement from leaners stating, "Oh yeah, the benefit, as I said before, they have to study it." Jerry continued, "Students are going to connect with this more than they will with just a lecture." He added, "Not only does it convey a lot of information in a quick way, it conveys it in a fun way that students are actually going to look at." Similarly, Natalie thought that infographics would encourage student attention stating, "They are going to pay attention." Tyler also thought the infographics activity would encourage student involvement. He said, "I think your outcomes are learning, I think you are really learning, learning a little bit better because you are more engaged in the content."

Discovery. Diane and Frank both addressed the learning benefit of discovery. They describe the opportunities of discovery in learning they perceive to be attributed to infographics including seeing the learning content unfold and develop and providing a way to visualize their learning.

> You know, it's so funny, PowerPoint enabled us to show these beautiful, complicated pictures and it seemed like such a great idea because we put it up there but students seem to have so many more of those light bulb moments when you start with a circle on the board and say here's a cell, here's a, because they see the story develop piece by piece. – Diane

> Diane continued,

> I realized that does not work, lecturing them, and I mean, I should have known that anyway I guess, lecturing over that doesn't work. So ever since then I've tried some kind of graphic in class and some have been better than others, but I think I just water it down and dumb it down too much, I give them such a, such a basic

template that I created and have them fill in the blanks, maybe it would be better off for them to go through the process you know, give them time to go through the process of putting the picture together themselves.

Frank suggested that during the process of developing an infographic students can experience 'discovery' of learning.

If they're actually producing infographics on there own, then they can have that, you know, potential discovery, and sort of see, again to go back to that term that I used kind of half jokingly before, but meta, you know, being able to see their own learning represented, you know, so you can kind of see that, it's helping them learn but then they can see what they've learned in the process all on the page, it's a, I mean, it's like reinforcement to me, you know, deepening.

Frank describes the experience he had with developing infographics and elaborates on how he wants his students to have the same opportunity.

I'm kind of a salesman for it [infographics] the more I talk about it… Actually what I'm saying though, I think I just actually talked myself into seeing it as valuable, and not that I didn't see it as valuable, more, but valuable even in [one of Frank's classes], worth the time to show the students how to do it, because if they can have the same experience with some, any concept somewhere along the way that I was having with a concept that I've taught literally three hundred times maybe a lot more than that, but I'm seeing it in a new, fresh way, well, you know I'd like for students to have that same experience so it would be worth it to you know, to bring it in, to make that happen, try and make that happen for them, so.

In addition, participants mentioned other concepts, which I grouped within this category. Among those are that infographics contribute to a 'fun' factor (Frank, Jerry, Natalie); provide a way to make classes better (Becky, Natalie); infographics encourage flexibility in learning (Natalie) and stimulate a social environment conducive for learning (Diane); process of developing an infographic is helps students learn how to condense and organize a lot of information in a small space (Adam, Becky, Jerry); and may be an activity to help teachers be more sensitive to learner needs (Becky, Diane).

Development of research skills. Participants identified the ability to research and the vetting of information as learning benefits (Adam, Becky, Jerry, Lisa).

Well it's another form of learning so they are going to have to go back and revisit the material so it's an additive or a form of memory recall and then areas that they are unsure about, they are going to have to go back and look that up to find out more about more information, make sure their information is accurate, organizational processes, anything that will require a process, or step by step process their going to have to go back and figure those things out – so that would be great for them to have to learn that. - Adam

Well, they're going to have to do research, because they're going to have to figure out, you know, they're going to have to get their data together…the student is going to have to go out and look at different areas and read different articles and figure out. - Becky

Jerry and Lisa also reflected on the research required to develop an infographic. Jerry said, "It encourages research, it encourages looking at little things that you might

not have, you otherwise pass over." Similarly, Lisa added, "It's just like anything else, you're going to have to research it, and look it up, or figure it out, or learn about it."

        Teaching infographics – cohort. This concept explores the thoughts and perceptions of participants about the teaching of infographics. Participants discussed instructional preparation, instructional processes, training environment considerations, student support and assistance, teaching skills and strategies. This section parallels the key concept/theme – *Developing Infographics* in that the concepts described involving the teaching of infographics influence the development of infographics. Challenges associated with developing infographics are addressed by providing suggestions on how infographics might be taught. The thoughts described herein regarding teaching infographics are provided based on the training experience each of the participants completed. Only one of the participants, Becky, had any prior experience using infographics in class. I grouped these teaching suggestions into five (5) instruction and support-related categories including:

- thoughts about teaching infographics,

- planning and preparing to teach infographics,

- designing an infographic lesson,

- instructing and supporting an infographic lesson,

- and a model for teaching infographics – the SKETCH Model.

Figure 45 provides an infographic view of the concepts mentioned by participants as being associated with teaching infographics.
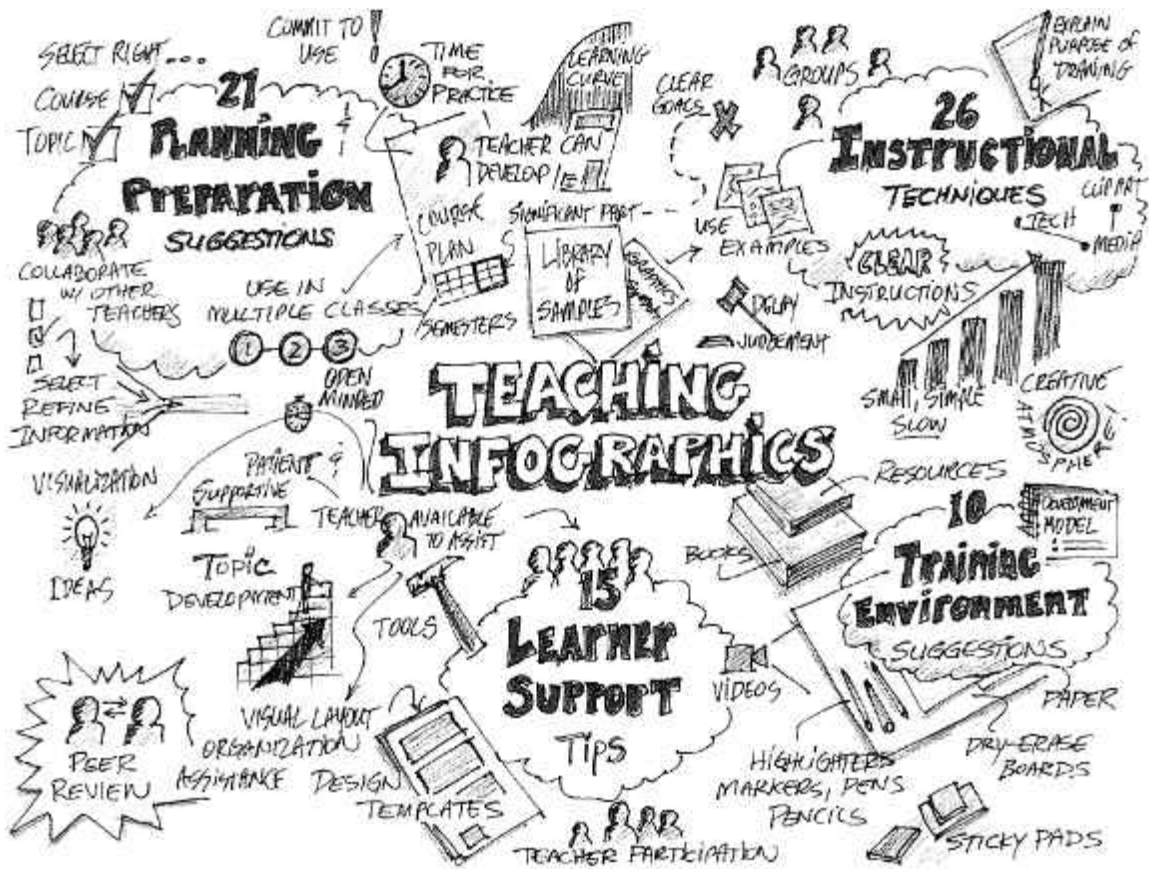
Figure 45. Teaching infographics – cohort perspective. Infographic depicts various concepts shared by participants associated with teaching infographics.

   ***Thoughts about teaching infographics*.** Participants shared general thoughts relating to the process of teaching infographics. Table 65 provides an overview of participant thoughts about teaching infographics. During the interviews, the participants described concepts that I categorized within the theme of "Teaching Infographics." Within this theme I grouped the concepts into five (5) categories. These categories include (1) planning and preparation associated with teaching infographics, (2) designing an infographic lesson, (3) teaching and supporting an infographic lesson, (4) challenges associated with teaching infographics, and (5) training environment considerations. Each

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of these categories is explored in the following sections. Each section contains a graphic and table providing details about the concepts.

Planning and preparation for teaching infographics. Participants described 23 factors that teachers might consider when planning and preparing to utilize an infographics-based assignment. Table 65 display these factors. These factors include preliminary thoughts, considerations, and realizations associated with deciding to use infographics as a learning activity. Additionally, skill development and training needs are presented along with suggestions for getting started with infographics. Participants shared thoughts regarding course selection and specific recommendations about how to prepare and plan for an infographics learning strategy.

Table 65

Planning and Preparation for Teaching Infographics – Cohort Perspective

Planning and preparation for teaching infographics	#	A	B	D	F	J	L	N	T
					Participant Comments				
Start small, build up; simpler infographics; limited use	8	•	•	•	•	•	•	•	•
Additional infographics training	7	•	•	•	•	•		•	•
Teacher should understand how to develop an infographic	6		•	•	•	•	•		•
Time for learning/dealing with the learning curve	5	•	•	•	•			•	
Demonstrate use; introduce on syllabus; or other instructor provided examples	3			•		•		•	
Commit to planning and developing infographic components; commit to use	3	•			•			•	
Realize that if may not go well the first time	3	•			•			•	
Develop a library/repository of infographic samples	3	•	•					•	
Take more than one semester, over a period of time; multiple phases/steps	2	•							•
Being able to adapt to new way of teaching; modify teaching approach	2				•			•	
Willing to be creative	2				•		•		
Approach with an open-mind	2						•	•	
Needs to be modeled throughout course	1								•
Should be a significant part of course; commit to use	1					•			
Introduce early in the semester	1				•				
Don't be afraid to make mistakes	1							•	
Pick the right course/topic	1							•	
Use in multiple classes	1					•			
Class time devoted to infographic training	1				•				
Collaborate with other teachers	1					•			
Read books about infographics	1					•			
Going to take some time, accept that it is not going to be easy at first	1							•	
Evaluate how to adjust existing class to accommodate the time needed for infographics	1	•							

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

All eight participants thought that when planning and preparing for teaching infographics that teachers should consider starting with limited use and smaller infographic assignments. Additional infographics training was also recommended prior to implementation (7 of 8). Most participants thought that it was important that teacher understand how to develop infographics themselves before asking students to develop

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infographics (Becky, Frank, Jerry, Lisa, Natalie, Tyler). The time needed to learn how to develop and implement infographic was emphasized by several participants (Adam, Becky, Frank, Jerry, Natalie). Participants thought instructors should be committed to utilizing infographics (Adam, Frank, Natalie), incorporating infographics as a significant part of the course (Frank), and realized that using infographics effectively may take more than one semester, and may need to be implemented incrementally over a period of time (Adam, Tyler). Teaching infographics requires planning and preparation involving the instructor's teaching style modifications (Diane, Natalie), needs to be embraced with an open mind (Lisa, Natalie), requires creative thought (Diane, Lisa), and approached without fear of making mistakes (Natalie). In fact, it was suggested that instructors considering infographics should realize that the experience may not go well the first time (Adam, Frank, Natalie) and accept that the experience will not be easy at first (Natalie). Planning and preparation also involved selecting the most appropriate course and/or topic for the infographic activity (Natalie). Diane thought it would be helpful to introduce an infographics assignment early in the semester, others suggested modeling the use of infographics in class (Diane, Jerry, Natalie, Tyler), use infographics in multiple classes (Jerry) and allow class time for infographics training (Diane). Participants also thought that teachers considering using infographics could benefit from collaboration with other teachers using infographics (Frank), learn more about infographics utilizing books/resources (Frank) and to develop a library or repository of graphics, symbols, and other infographic components (Adam, Becky, Natalie).

   Designing an infographic lesson. Table 66 provides a detailed listing of thoughts shared by study participants relating to how an infographic lesson might be designed.

The thoughts shared by participants are arranged from most to least according to the number of participants that mentioned the concept.

Table 66

Designing an Infographic Lesson – Cohort Perspective

Designing an Infographic Lesson	#	A	B	D	F	J	L	N	T
				Participant Comments					
Use a process, model, step-by-step approach	7	•	•	•	•	•	•	•	
Practice, multiple opportunities	6		•		•	•	•	•	•
Important how infographics are introduced; highlight benefit and value	4		•	•				•	•
Allow for revision, flexibility, freedom to create	3		•	•				•	
Make it fun	3			•		•		•	
Provide time for practice	3					•		•	•
Start out with smaller or simpler infographics	3			•				•	•
Use a common activity with a familiar topic	2	•						•	
Provide clear instructions	2			•			•		
Be mindful of time given for assignment	2			•		•			
Set clear goals and communicate those goals	1					•			
Avoid the theoretical side	1					•			
Should follow an instructional activity; preliminary assignment; lecture	1					•			
Realize learning something new may be overwhelming	1					•			
Realize that everyone may not know how to develop an infographic	1								•
Determine the appropriate level of assignment complexity	1					•			
Determine whether to provide data or have student research	1			•					
Challenge students	1							•	
Be mindful of student knowledge base	1					•			
Delay sketching until later	1							•	

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Most participants (7 of 8) thought that teachers, and students, would benefit from utilizing a process or model; something to guide learners through the development of an infographic. Participants also thought that learners should be given ample time for practice and provided with several opportunities to work with developing infographics (Becky, Frank, Jerry, Lisa, Natalie, Tyler). Participants mentioned that it was important how infographics are introduced to students (Becky, Diane, Natalie, Tyler) emphasized

that infographics activities should be fun (Diane, Jerry, Natalie), be smaller and less complex at first (Diane, Natalie, Tyler), and be based on common activities or familiar topics (Adam, Natalie). Participants commented that infographic activities should have clear instructions (Diane, Lisa), clear goals (Frank), avoid theoretical concepts (Frank), and follow an instructional activity such as a lecture (Diane). Suggestions also included designing infographic lessons with an understanding that students may not be familiar with infographics (Tyler), consider the existing learning knowledge base (Diane), realize that learning a new concept may overwhelm students (Diane), and design lessons that challenge students (Natalie) with the appropriate level of assignment complexity (Diane). Other considerations include a determination on whether to have the students locate the data for the infographic or whether the teacher will provide the data (Becky).

Instructional and support strategies. Table 67 provides an overview of participant thoughts regarding the instructional and support aspects associated with infographics. Participants shared 29 suggestions about instructing and supporting learners to develop an infographic. All participants thought that instruction and support should involve the use of groups.

Table 67

Instructing and Supporting an Infographics Lesson – Cohort Perspective

Instructing and supporting an infographic lesson	#	A	B	D	F	J	L	N	T
				Participant Comments					
Provide examples/samples of infographics	8	•	•	•	•	•	•	•	•
Use groups	8	•	•	•	•	•	•	•	•
Address concerns students may have with sketching/drawing; explain role of drawing/sketching	7	•	•	•	•	•	•	•	
Demonstrate, provide examples, work along with students	5	•			•	•		•	•
Provide tools, resources, cool stuff	5			•		•	•	•	•
Show examples, samples, early design sketches of infographics	5	•	•		•	•	•		
Provide students with design template, design options	4		•			•	•	•	
Be available for students	4	•	•					•	•
Delay judgment; don't expect perfection; give learners permission to screw up	4		•		•	•		•	
Practice what you preach; instructor use of infographics	4			•	•	•			•
Be ready with ideas; help with visualization; design choices	3		•		•	•			
Teacher participation/involvement/support	3			•	•			•	
Develop training videos, webcasts	3	•			•			•	
Don't move too quickly; spend some time	3			•		•		•	
Use technology/internet/images/clip art	2						•		•
Be up front about time commitment	2						•	•	
Start with a group assignment; individual assignment later	2	•		•					
Be patient and supportive	2			•				•	
Help learner develop topic for infographic	2	•					•		
Provide technology training for those that would like to use technology tools	2					•			•
Provide visual layout and organization assistance	2			•	•				
Use labels to offset drawing limitations; written portion to explain	2		•					•	
Provide help selecting/refining information	1	•							
Incorporate peer reviews	1	•							
Bring in a trainer to assist	1						•		
Inform students up front about materials needed	1			•					
An infographics about infographics	1	•							
Drawing practice/training	1						•		
Develop a non-threatening learning environment	1							•	

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Training environment considerations. I asked participants to share thoughts they had about how the training environment might be set up in order to teach infographics. Were there materials that needed to be available? What resources and teaching materials would be helpful? The participants did not have any previous experience setting up a training environment for infographics. I was interested to see what the participants

thought about the training environment that I utilized for the infographics training and if there were any suggestions for improvement. I also utilized observation data for the trainings so I could see which materials were utilized. The training environment thoughts shared by the participants reflect the materials that were utilized during their infographic training experience. The training environment suggestions include room type/configurations, instructional technology, resource materials, and reference materials. Table 68 provides the suggestions by participant.

Table 68

Training Materials and Resources for Teaching Infographics – Cohort Perspective

Training materials and resources for infographics	#	A	B	D	F	J	L	N	T
Individual white boards/dry-erase boards	4	•		•		•	•		
Highlighters, markers, pens, pencils	4	•	•	•	•				
Training packet, SKETCH model	3						•	•	•
Paper	3		•	•			•		
Books, resources	2		•				•		
Foster a creative atmosphere	2		•	•					
Document camera and projection system	1	•							
Sticky pads	1					•			
Materials (non-specific)	1							•	
Videos	1								•

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Overcoming challenges and resistance. Throughout the study participants had suggested challenges or factors that influence the use and teaching of infographic in post-secondary education. Participants also provided suggestions about overcoming teacher resistance. Table 69 provides suggestions that participants shared to overcome teacher resistance to infographics. Adam, Diane, Frank, Lisa, and Tyler thought that demonstrating the benefits of infographics utilizing statistical and data from studies might help overcome teacher resistance. Diane, Frank, and Natalie shared that it might be

beneficial for a small group of faculty to develop infographics and share the experience with others. Adam and Diane thought that showing examples of infographics from different disciplines and subject areas might help overcome resistance to using infographics.

Table 69

Overcoming Teacher Resistance to Infographics – Cohort Perspective

Thoughts about overcoming resistance to infographics	Participant Comments								
	#	A	B	D	F	J	L	N	T
Provide success rates, statistics, study data	5	•		•	•		•		•
Small groups of faculty develop infographic and share with others internal and external to academic discipline	3			•	•			•	
Show how infographics might be used in different disciplines/show connections	2	•		•					
Dealing with stigma associated with this type of assignment 'breaking out the crayons'	1								•
Student surveys about using infographics	1		•						
Colleague discussions about using infographics/forum for discussion	1						•		
Important how it is introduced to faculty	1					•			
Develop infographic with data supporting benefits	1	•							

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Assessing with infographics – cohort. In this key concept, participants relate their thoughts about using infographics as a means of assessing learning in post-secondary education. Data for this section is derived from reviewing participant responses on the interview transcripts and grouping assessment-related comments into the key concept "Assessment with Infographics." Analysis during the coding process produced five (5) subcategories within the key concept. These include the following:

- participant thoughts about using infographics as an assessment;

- participant thoughts about using an infographic as an alternative to another assignment;

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- factors influencing the use of infographics as assessment in post-secondary education;

- participant thoughts about how to assess an infographic;

- and participant questions and/or concerns associated with using infographics as assessment.

Figure 46 provides an infographic view of participant thougths and perceptions about using infographics as assessment in post-secondary education.
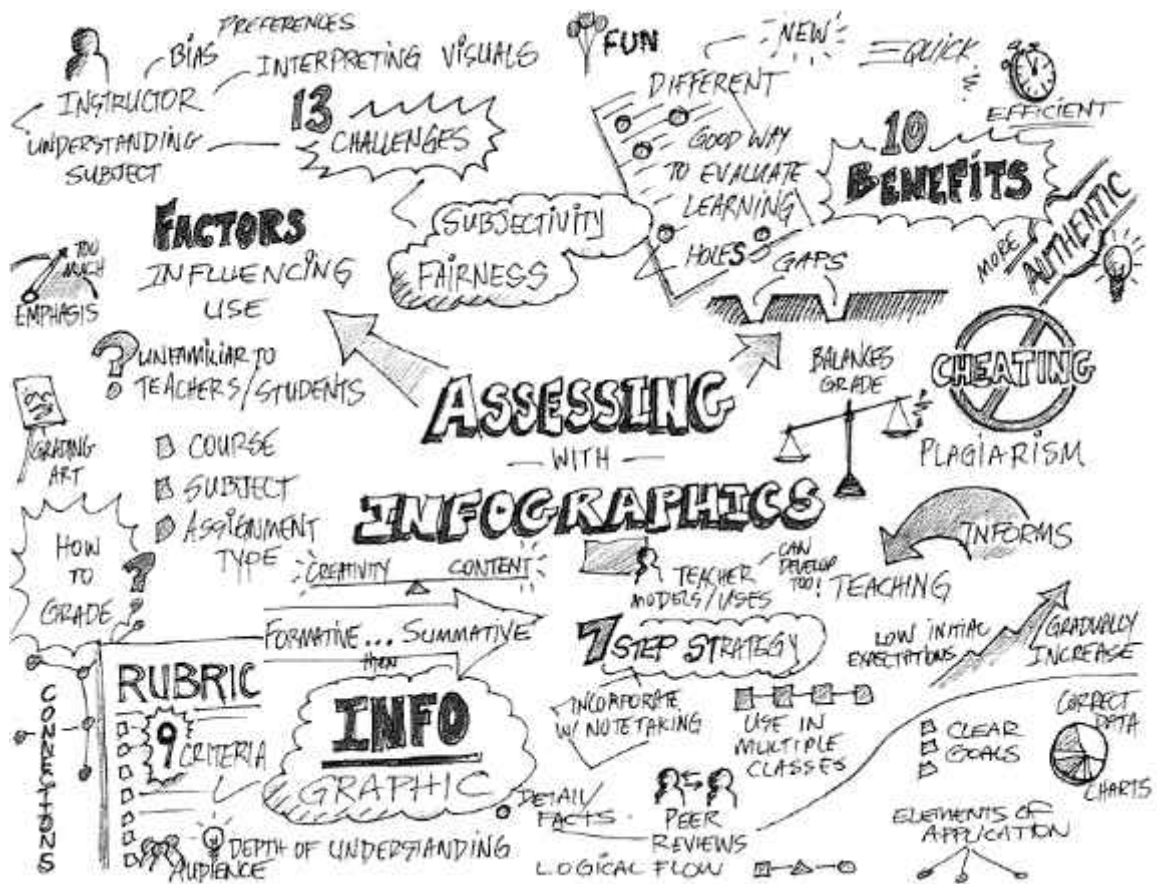
Figure 46. Assessing with infographics – cohort perspective. The infographic depicts the various topics participants shared associated with the concept – Assessing with Infographics.

Thoughts about using infographics as an assessment. Participants described 16 specific concepts related to using infographics as assessment in post-secondary education. These assessment concepts are included in Table 70.

I reviewed the participant contributions related to assessment and grouped the concepts into ten (10) categories; some with subcategories as identified in Table 70. Table 70 includes the concepts mentioned along with the number of participants mentioning the concept and a notation for each participant responding.

Table 70

Assessing with Infographics – Cohort Perspective

		Participant Comments							
Thoughts about using Infographics as an assessment	**#**	**A**	**B**	**D**	**F**	**J**	**L**	**N**	**T**
1. Good way to evaluate learning/demonstrate understanding	7	•	•	•	•	•	•	•	
a. Good way to see how students can think on feet	1								•
b. See gaps in learning right away	2		•	•					
c. Really have to think	2		•					•	
d. New way of communicating learning	1						•		
e. Easier way to assess critical thinking	1	•							
f. Fun, easy, and effective	1			•					
2. Quick, efficient form of assessment	5			•	•	•	•		•
3. Mitigates plagiarism, cheating,	3			•	•			•	
4. New and different way to measuring learning	2					•	•		
5. More interesting to grade; something different from every student	2			•					•
6. Assessment of teaching/inform teaching	2			•	•				
7. Reduce student test anxiety/not like a test anymore	2							•	•
8. Authentic assessment of learning	1			•					
a. Benefit student more than regular exam	1			•					
9. Open teacher minds to other ways of teaching/learning	1						•		
10. Balances the grade	1						•		

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Good way to evaluate learning/demonstrate understanding. Seven of eight participants thought that infographics would be a good way to evaluate learning and demonstrate understanding. Diane and Jerry's comments below reflect the overall thoughts conveyed around this concept.

I think it's excellent, I'm not sure I understand all the ways it can be used best but I'm definitely, I'm sure that it can be used, at various degrees. Some people will use it you know, different instructors will use it in different ways, but yeah, I think it's an excellent form of assessment in our discipline and in post-secondary education in general. - Diane

I asked Diane if she thought using an infographic assignment would help teachers assess the learning of their students. She replied,

Absolutely, they're going to see, you see the gaps right away, I mean, even in just simple sketches and you're going to have some insight into that big picture if they're formulating, if they're making the connections they need to be making, if they're doing more than just memorizing facts, which is really important, and I think it will probably be really helpful to us too, I think it may cause us to teach things in a different way sometimes because the connections that we'll see from the student perspective.

Diane also wanted to share with other post-secondary teachers, "How fun, and easy, and effective it can be. It's a, it's a great way to evaluate your student getting the big picture about something in an efficient way that's easy to grade."

I asked Jerry the same question, can an infographic be used to assess learning?

Jerry replied,

> Oh yeah, it shows whether they understand [laughs] the topic. You know, even
> though we say, you know I said earlier that the students' vision of it in an
> infographic might be abstract and a little off I think you know, if, if the teacher
> just wrote back and said well you know, explain that to me, you know, if the
> student could, sure, but it's still a way of determining whether their overall
> understanding of a topic or a whatever is accurate so yeah, I like that, as I said
> before, to be able to an infographic half-way right, you have to understand your
> subject so, that's just good instruction.

> Jerry added, "I think it's a great assignment for determining whether they

understand the subject or the, what you're working with…"

> Adam commented on the infographics ability to assess critical thinking stating,
> I think it is an easier way to assess critical thinking skills too because there are
> several different components of critical thinking that have to go into it, for the
> whole step process, planning process, not just the outcome of it.

Natalie, Becky, and Frank all had different perspectives relating to infographics as
assessment.

> This would force them to actually show if they have an understanding. So that is
> what I like. Even if it is not perfect it would still make them have to really think
> about it. Like okay, how can I present this so that she knows that I understood you
> know, that section of the chapter. - Natalie

You would be able to really see what the students are learning and see where you

are lacking. See where you're lacking in your teaching and what you need to be,

working on to help the student to better understand the material." - Becky

"In something like this you know, it's either they got it or they didn't, you know,

it's stuck in their head or not. - Becky

I was having trouble sort of articulating earlier, or even just thinking through that

to visualize something to the extent to where you do an infographic you've got to

understand it pretty well already, and of course that leads to assessment and so

forth. – Frank

Quick, efficient form of assessment. Several participants commented that the

infographic might be a quicker, and more efficient assessment of student learning when

compared to other forms of assessment. Diane, Jerry, Lisa, and Tyler mentioned that they

thought there might be some efficiency to be realized in the grading of an infographic

assignment.

Diane thought that infographics were a "quick, efficient way to evaluate a large

amount of material." She added that infographics could be efficiently graded stating,

"It's [infographic as assessment] efficient, it's a lot more efficient than writing

papers. In a classroom I can walk around the room and very quickly, if I give

them, even just fifteen minutes, in that amount of time, I can see if they're putting

the big picture together or not.

Diane expands on other assessment related benefits.

Sometimes when people talk about how they let students revise papers over and

over, and you may do this, and it's probably really good. I'm too lazy to do that

because it seems really stressful to me to go through lots of revisions. I think

they're, that, that can probably be really good but depending on how many

students you have it's not practical and you get frustrated. This [emphasis] I could

see lots of revisions and not being stressful. That's one of the reasons I do those

quick drawing assignments cause I can grade them really, really fast. So it would

cut down on the, we all complain about that right, the grading workload, I think it

would be nice to spin it on how efficient that can be. – Diane

Jerry, Lisa, and Tyler also shared perceptions regarding the efficiencies in grading

associated with infographics. Jerry said, "It takes up less space [laughs] and, and provides

about the same information," Lisa stated, "I think you could probably grade an infograph

maybe quicker." Tyler added,

If I had to read a five-page paper from everyone over the same topic it's going to

be the same thing rehashed over and over again right, so it would be definitely, it

would be good from my, on my end of it just to make sure I could make a quick,

look at how they're learning. Yeah, why, you know, why grade ten problems

whenever you can just [look at the infographic and see] if they can explain the

process real quickly.

Lisa expanded on her earlier observation highlighting the grading efficiencies of

infographics.

 An infograph might actually be a little easier to grade maybe [laughs] cause like

you say it's all one page, you can look at it, I mean… everything's kind of in one

spot… maybe an infograph, now that I'm sitting here thinking that might even be

a little easier to, to grade because, it's all in one place and you don't have to

[pause] read through it, and try to make sense of it in that way and it's like saying the same thing just in a different way. So, I don't know, I think it might be simpler.

New and different way to measure learning. Frank and Lisa both mentioned how the infographic assignment might be a new way to measure learning.

We could definitely, get at, use this as a way of, getting at some of the same concepts and assessing how well they're attaining, and again it might even bring up a different wrinkle to it, to show, you know, in rhetorical analysis I have them do, it's answer this set of questions and answer this set of questions and you know. – Frank

"I think it opens our minds to other ways of, of [pause] teaching and student learning, and it's another way of assessing grades, another way of measuring learning." - Lisa

Authentic assessment of learning. Becky describes how developing the infographic influenced her and shared her thoughts on infographics and assessment. She suggests that an infographics-based assessment may provide a more authentic assessment of student learning than that provided by traditional, objective assessments. She said, "I think it would benefit the student way more than doing a regular exam." Becky expanded on this thought,

This is better than a multiple choice question you know, it really makes the student think, it makes me think, you know, anybody who has to do one of these it's going to make them think more about the subject than what they would think

about in a standard, you know, question test. It's you know, except maybe fill-in-the-blank, you really have to think about those [laughs].

Becky added,

I just don't think, I'm just never been a fan of your standardized test because, it's easy, well it's not easy but, it's easier to guess the right answer than to really show that you know that information, and by creating an infograph you have to really show you know that information and in doing so, even if you don't know something at that time you learn it you know, as you're putting it into that so, it it's you know, it helps them to go back and reflect on everything they've learned you know, in the class and if you're doing this like a final you know, to help them, you know, say what did you learn in this class, helps them to look at every, go over everything that they've learned or at least look at it you know, maybe not go through it thoroughly but look at it and pull out the most important things to them that they learned plus it also helps you to assess what you were able to teach them.

Becky continued,

 As far as the way it's influenced me is thinking more of getting rid of quizzes and having assessments that are based more on what the student really knows instead of what's the best way to answer this question you know.

She stated further,

That [an infographic activity] would make them think so much more than just a regular, you know, multiple question exam's going to do, because, you know, they're just going to use deductive reasoning on the a,b,c or d, you know, which

one sounds like it might go best [laughs], you know, where if you are actually, it's like the difference between a fill-in-the-blank and a multiple choice, you have to really think about a fill-in-the-blank you know, the answer's not already there for you to choose, you have to come up with it. So I think you have to think a lot more about that and understand your subject a lot more.

Becky touched on something with infographics as assessment that was only mentioned by one other participant, Diane. Becky and Diane suggested that not only was an infographic a good way to assess student learning but it could also be a way to assess teaching. Becky thought that infographics could help teachers to "assess what you were able to teach them [students]." Becky expanded on this concept by saying "I mean because [laughs] if they all turn in very poor infographs then you're like [laughs] well, I think I might have failed them, you know, and you go back and revisit the areas that they're all lacking in." She added, "If nobody's mentioning that [a key lesson concept] then you know, I really need to beef up that section in my class, you know, and talk about that a lot more." Similarly, Becky describes the informative capabilities of infographics.

You would be able to really see what the students are learning and see where you are lacking. See where you're lacking in your teaching and what you need to be working on to help the student to better understand the material." - Becky

Diane commented, "I think it will probably be really helpful to us too, I think it may cause us to teach things in a different way sometimes because the connections that we'll see from the student perspective.

Diane continued,

Yeah if there's a concept that your students always seem to struggle with, you

may, by looking at an infographic assignment, you may see, well, no wonder, fifty

percent of the class never saw that these two things were, they never represented

any sort of relationship here, and that's sort of foundational.

*Mitigates cheating and plagiarism***.** Diane, Frank, and Natalie suggested that the

infographic assignment by its very nature might alleviate cheating and plagiarism. This

concept was not brought up by any of the other participants. Diane stated, "And

plagiarism you're going to know [laughs] in half a second. It's totally eliminated."

Similarly Frank commented, "I guess this comes back to assessment too, it's hard to, be

hard to fake it even if you have good art skills and all that…" Natalie agreed, "I think you

can't cheat on this [laughs]"…"There's no cheating going on here. [laughs]…"I mean

[laughs] it would be one way to kind of eliminate that (cheating)."

Participants also thought that infographics might help reduce test anxiety (Natalie,

Tyler); open teacher minds to other ways of teaching, learning, and communicating

learning (Lisa); provide students with more opportunities to demonstrate understanding

(Lisa); and be more interesting to grade because each student would submit something

different (Becky, Tyler).

*Using an infographic as an alternative to another assignment***.** I was also

interested to learn if the participant thought an infographics assignment could be used as

an alternative to an existing assignment. Would an infographics assignment provide the

same level of learning as an existing assignment? All of the participants indicated that

infographics could be used as an alternative to an existing assignment and used to assess

learning. Some participants provided examples of how infographics might be used to replace an existing assignment. Infographics could be used as a substitute for: a writing assignment (Frank, Lisa, Natalie); a critical thinking/critical reading assignment (Frank, Lisa); a speech (Lisa); a class project (Frank); an exam (Becky, Lisa, Natalie, Tyler).

Adam and Frank added that even though they could use infographics as an alternative assignment, they indicated that they would use it for some items and more as a supplemental activity rather than as a substitute for another assignment. Adam indicated that he could see it being used in several different ways but indicated that at this point he would be more inclined to use infographics to supplement his courses.

> I was getting ready to say, possibly an alternative but more of a supplemental than alternative, at this point." Adam also said, "I can see it maybe not as an alternative for every single item, but I can see it for several different avenues especially when we are looking at the body and going through different forms of muscle contractions and there's different terminologies that go into that, can they understand those things and those are concepts that students have a difficult time learning so I can see how that can definitely be beneficial.

> Frank wasn't sure about completely replacing his writing assignments with an infographic. Frank said, "I can see it being an alternate assessment for some things, you know, not replacing, you know, most of my major assignments that I currently have, or types of assignments." Frank went on to say that he could see where infographics could be used in his [specific courses] and that the use could be a way to infuse variety into instruction.

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With a writing course, that, you know, as great as the visuals are, they can't be a substitute for the writing itself, for the most part, but as I said, you know, with individual assignments I could see where we could do this in lieu of some small writing assignments and it would be nice to break things up if nothing else.

***Grading infographics – cohort*.** If the participants thought that infographics could be used as an assessment in post-secondary education, I wanted to see if they had any thoughts about how an infographic could be used to assess learning. In this section, I include participant suggestions on methods for assessing infographics, provide participant thoughts about the artistic influences and how these influences might impact assessment, and provide participant thoughts and prescriptions for incorporating and using infographics to assess learning.

Rubrics, checksheets, guidelines for assessing infographics. All participants thought that infographics should be graded using some sort of rubric, check sheet, or guidelines. This correlates to the suggestions by Abilock and Williams, (2014); and Davidson, (2014). Diane and Jerry provide insights into the use and need for using rubrics.

If you don't have a rubric that says I need to look for three things in this infographic, you're going to kill yourself thinking if you're being fair between students or, well maybe you know how it is, if you don't have a good set of instructions, the really outstanding papers sort of sets the tone and everything else doesn't look as good [laughs] or you think well maybe I need to go in the middle. So having good guidelines in the beginning I think is really important. And some people, I don't know, I mean, some teachers may not be as artistically inclined

and it might not come as naturally for them too. But in that situation, the emphasis

would just be maybe simpler infographics, or still you know, the basic rubric.

Students may be encouraged by the fact that the teacher uses really simple ones

too you know. - Diane

I think you could work up a rubric that sort of gives you areas that you want to see

as part of it, you certainly would want to see some depth, you know, and you

could include that in your rubric you don't want to just see one little picture

unless it's very well done but, but you want to see some other areas so you'd have

to work with it but I think you could have a structured way of interpreting it

where you could give assessment. - Jerry

Jerry added,

I think so because there's so much information that can be in an infographic I can

see a lot of instructors putting a lot of emphasis on it because of that and I think

it's good to have guidelines to start out slow with that until the instructor and the

student understand what's going on you know, then you can start really assessing

it more in depth. But yeah, I like that idea of, of, of providing a rubric or some

kind of guidelines to assist with that cause I think instructors are going to be

wanting that [laughs] cause they're just going to, it's sort of wide open as to how

to assess it.

Suggested criteria for an infographic rubric. All of the participants (with the

exception of Natalie) shared thoughts and suggestions about items that might be included

in a rubric for grading infographics. As stated earlier, many of these participants had no

previous experience with infographics and as a result, their suggestions for assessing a

rubric may be based more on the experience they had developing the rubric as opposed to actual experience grading infographics. Nine (9) grading elements or grading criteria for an infographic rubric were suggested and are displayed in Table 71.

Table 71

Rubric Criteria for Assessing Infographics – Cohort Perspective

		Participant Comments							
Participant suggestions for infographic rubric criteria	#	A	B	D	F	J	L	N	T
1. Depth of understanding displayed, key concepts clearly communicated	7	•	•	•	•	•	•		•
2. Level of detail, specific facts	4		•		•	•			•
3. Aesthetics	2	•	•						
4. Logical flow, organization, sequencing	2	•							•
5. Audience considerations; relevant to audience	2	•					•		
6. Clear goals	1						•		
7. Infographic quickly, easily, clearly read, appropriate graphs/data; functional	1		•						
8. Balance between creativity/instructional content	1				•				
9. Elements of application	1						•		

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Tyler described how he might grade an infographic and provides suggestions.

> I would probably sit down and try and grade these things, you know, as fairly as possible from person to person but if, yeah, I think it would have to be along the lines are they showing, is there a true display of understanding I suppose right do you understand what's going on with this content, if we were going to try and assess that you understand this content, then you would have to really be able to show it and how they showed it, it would be, I guess, some type, would be surprising for different people, right, the way they described it. He offered, Tyler provided additional guidance regarding rubric criteria.

The advice I would give the student, is that they should be able to take this and

hand it off to someone that's, never been in the course that has, you know, very

basic skills about this, and be able to look at it and say, oh yeah that, that makes

sense you know what I mean, so, that would be part of my rubric but than that

would also, that would also mean that they understand, they would completely

understand how to do something.

Frank commented on how the goals for the course could influence the infographic

rubric criteria.

I think if an instructor understands, you know, clearly, the goals that they have for

the class, then you know, that should, that they should be able to then know what

they are assessing for more clearly and you know.

Infographic content independent of graphics quality? I was curious to find out if

the participants thought about how the quality of the graphics in an infographic might

influence the grading. Table 72 shows a summary of their responses.

Table 72

Assessing the Graphic Quality of Infographics

		Participant Comments							
Assessing the graphic quality of infographics	#	A	B	D	F	J	L	N	T
Content independent of artwork/graphics quality	8	•	•	•	•	•	•	•	•
Graphics quality has potential to influence grade	2				•	•			
Graphics quality might depend on subject	2	•					•		

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

All of participants thought that the content of the infographic could be evaluated independent of the graphic quality. Becky, Diane, Frank, and Lisa had the following insights:

I don't think it should be about the drawing. In my class it, it is, it's going to be, there's going to be a technical side to it that's going to be about the drawing but in all the other classes, there probably, probably shouldn't be, it shouldn't be about what it looks like at all other than is it easy, you know, to conceive the idea. – Becky

You know, I like pretty, artistic representations of things, but as a teaching tool, as long as the information is there, that's fine with me…actually, I would rather see a stick heart with the right information than, you know, than them laying a piece of paper over the heart in their book and drawing it to make it look perfect, you know what I mean? - Diane

Oh yeah, it's definitely, it's got to be about the concepts, otherwise it's going to become about the art, it's going to become about the end product, the presentation, how fancy it is, how pretty it is, how artistic and that's not the goal, it's, we can't make it about the graphic over the info. It's got to be the info over the graphic. - Frank

They're all forms of communication and they're all ways of learning so, and, you know, but no matter if they do a paper, or if they do a speech, or even if they do an infograph, I would grade them, I would have, you know, I would grade them all the same. You know I look at that thinking and you know grade them all the same I would. - Lisa

Potential for grading influences. Two of the participants, Frank and Jerry also cautioned that they thought the potential is there to let the graphics quality influence the grade.

> That's why I said, the assessment's the tricky part, and, and I think you're right if someone comes in with all these bells and whistles and flash and jumps around you know, the instructor's going to be impressed whether the [laughs] information may be a tad weak. - Jerry
>
> Well, I, compare that to, this just occurred to me, taking that to an essay you know, it might look great at first glance but after, and you have to read into it, but sometimes, you get into it and you have students who are, you know, very good at communicating, that they have maybe a large vocabulary, they can turn a nice phrase, but there's really no depth to it, there's no content to it, so it might, on the surface look very good and so I think the same thing could apply here where you might have somebody who's using their skill at artwork to cover up for their lack of, you know, deeper understanding. - Frank
>
> I definitely see the potential here and maybe more so than other things, maybe, to be picky about it or, to be, or to, to not be, if you don't have clear goals about what's important, what's not, then you could get into like, you know, the picture's not being big enough or the, to use this one on the front page, oh this arrow is not really pointing where it ought to point, you know, and get into things like that so I guess the potential is there for people to assess things that don't really matter. - Frank

Subject/course distinctions. Becky and Lisa pointed out that different subjects might require a higher level of graphics quality and that in these subjects the graphics quality might be part of the grading criteria.

We could grade on the technical aspect of it, the content aspect of it, I think it might be a little bit harder for us as far as that goes, but easier for some other disciplines, you know, history or science, or math, or something like that, that is more, more factual you know, instead of, artistic. I think it would be a whole lot easier to grade an infograph as a form of assessment in those disciplines but ours [Becky's academic discipline] is artistic, it's like, it's in the eye of the beholder, you know, you've got to really focus on the technical aspect of it. - Becky

It might depend on the subject too. I mean like what I teach, I probably wouldn't let it [drawing quality in graphic] influence my grading if it, you know, if it wasn't required but now if I was teaching something like Visual Communications [laughs] or something like that, to where it, you know, had to be this polished, you know, thing, that might be different. - Lisa

Suggestions for initiating an infographics assessment strategy. Participants had various suggestions for an infographics assessment strategy as shown in Table 73.

Table 73

Suggested Infographics Assessment Strategy – Cohort Perspective

Participant suggestions for an infographics assessment strategy	#	A	B	D	F	J	L	N	T
Lower expectations early on, less emphasis on grade	4			•	•	•			•
Making sure instructor can develop infographic first	2							•	•
Incorporate as part of note-taking strategy	2							•	•
Peer reviews	1	•							
Use in multiple classes	1					•			
Start with formative assessments advancing to summative	1								•
Incorporate as part of way students are introduced and subsequently assessed	1				•				

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

The participant suggestions for implementing an infographics assessment strategy include having lower expectations early on in the class with less emphasis on grading the infographics (Diane, Frank, Jerry, Tyler); making sure that the instructor knows how to develop an infographic before grading student infographics (Natalie, Tyler); using infographics as part of a note-taking strategy (Natalie, Tyler); utilize peer reviews so that students can help assess each others infographics (Adam); using infographics in multiple classes so that students can become familiar to the concept (Jerry); using infographics initially for formative assessment working way up to summative assessment (Tyler); and using infographics to introduce students to content so that they become familiar with the concept and then later use infographics to assess their learning (Frank). Becky and Lisa did not provide suggestions for employing an infographic assessment strategy.

Assessment challenges. This section includes participant thoughts and perceptions related to factors that may influence the use of infographics as assessment in post-secondary education. Table 74 provides a detailed listing of assessment challenges by participant.

Table 74

Challenges Associated with Assessing Infographics – Cohort Perspective

Challenges assessing infographics	#	A	B	D	F	J	L	N	T
Grading challenges; some type of challenge indicated	8	•	•	•	•	•	•	•	•
How to grade fairly; wide-open on how to assess; subjectivity of grading	4		•	•		•			•
Time and effort required, payoff worth investment	3		•		•			•	
Assessing infographics in general; concerns about rubric used	3	•			•	•			
New way of assessing, unfamiliar to students and teachers	3	•	•	•			•		
No questions of concerns; no overall questions or concerns	3		•		•			•	
Instructor interpreting student visuals	2					•		•	
Differences by discipline/class/assignment type	2		•		•				
Class type; common courses	2					•			•
Instructor understanding	2	•			•				
Grader bias/preferences	1	•							
Placing too much emphasis	1					•			
How to grade art	1								•
Tricky to grade	1					•			
Instructor knowledge of subject	1					•			
Common assessment practices within discipline (common finals)	1							•	•
Student not really understanding material to begin with	1								•

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Participants in the study had questions and concerns along and identified perceived challenges associated with using infographics as an assessment. All participants indicated that they would anticipant challenges with grading an infographic. These grading challenges include: instructors having difficulty interpreting the student visuals (Jerry, Natalie); perceived challenges with being able to grade an infographic

fairly (Becky, Tyler); subjectivity of grading (Diane, Jerry); instructor knowledge of subject to grade a student developed infographic (Jerry); and teacher bias and preferences because of the way they [teachers] were taught (Adam). Diane thought that instructors not 'artistically inclined' might have more difficulty with an infographics assignment. Jerry added that he thought that instructors might be inclined to place too much emphasis on the infographic. Becky, Natalie and Frank mentioned time and effort required to grade an infographic assignment as a challenging factor. Becky thought that grading would take more effort than when grading a traditional assessment. She thought that traditional assessments could be automatically graded within a learning management system whereas the infographic would require a rubric and manual grading. Participants Becky and Frank thought that the type of class could also make a difference. Becky thought that an 'artistic class' might require a different approach to assessment compared to what she refers to as a 'factual-based' class. Frank thought that some classes might be a better for infographics than others. Tyler and Lisa both teach in academic disciplines that utilize a common final. They indicated that they might be limited as to how much they could deviate using an alternative assessment such as an infographic for a final exam. Further, Becky thought that there would be a difference in a class where the teacher provided the data for the infographics as opposed to a class where the teacher required the students to research the data for the infographic. Additional questions and concerns associated with using infographics as assessment included: teachers being unfamiliar with the process for developing infographics (Adam); students being unfamiliar with process for developing infographics (Diane); and students understanding material well enough to develop an infographic (Tyler).

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Developing infographics – cohort. One of the key concepts emerging from the coding process was a collection of perceptions from the participants about their experiences developing infographics. The thoughts the participants shared were grouped into four subcategories. These subcategories include the following:

- factors influencing the development of infographics;

- intuitive aspects of infographic development;

- skills necessary to develop infographics;

- and thoughts about sketching infographics compared to using technology tools.

At the completion of the training and after the participants had developed an infographic I wanted to see what they thought about the process of developing the infographics. Specifically, I wanted to see what they perceived to be factors influencing and impacting the infographic development process.

Factors influencing the development of infographics. The participants identified 12 factors that they believed influenced the development of infographics. These factors are displayed in Table 75. Participants of this study developed their infographic using the SKETCH model for infographic design. This particular model utilizes as hand-drawn or sketch-based approach to developing infographics. The factors provided by participants were arranged into three classifications.

Table 75

Factors Influencing the Development of Infographics – Cohort Perspective

Factors Influencing the Development of Infographics	#	Participant Comments							
		A	B	D	F	J	L	N	T
Primary Factors									
Learning curve, extra work, time involved	8	•	•	•	•	•	•	•	•
Artistic/drawing ability	8	•	•	•	•	•	•	•	•
Learning Style/Learner Types	7	•	•	•		•	•	•	•
Visualization Abilities	7	•	•	•	•	•	•	•	
Secondary Factors									
Understanding content enough	5	•	•	•		•			•
Following steps/process/understanding how to develop an infographic	5	•	•				•	•	•
Design, Layout, Organization, Sequencing	4	•	•	•	•				
Selecting/Coming up with a topic	4	•					•	•	•
Tertiary Factors									
Visual impairments, disabilities, ADA	3	•		•					•
Creativity	2	•					•		
Using the right data	2		•			•			
Overall a challenging activity	2	•			•				

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

The first grouping (primary factors) illustrates those factors that were identified by most of the participants. The second grouping (secondary factors) identifies those factors that were mentioned by at least half of the participants. The third grouping (tertiary factors) includes factors that were mentioned by less than half of the participants.

Of the 12 factors mentioned by the participants, four primary factors stand apart from the others. These factors include the learning curve/extra work associated with learning and teaching infographics, artistic/drawing ability, learning style/learner type considerations, and visualization abilities.

Learning curve, extra work, time commitment. All eight participants thought that the learning curve and/or extra work, and time commitment associated with infographics

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would influence the development process. Concepts associated with the learning curve and extra work with an infographic assignment include:

- extra work for students on top of already challenging classwork (Tyler);

- concern for the extra time involved to develop infographics (Tyler, Frank, Diane, Jerry, Adam);

- the learning curve associated with infographics (Frank, Lisa);

- the extra time/effort needed to teach infographics (Becky, Jerry);

- time needed to practice drawing (Becky);

- and the potential for an infographics activity to be an additional student 'stressor' (Lisa).

Artistic/drawing ability. This study utilized a form of infographic design that required participants to hand-draw or sketch the infographic. All participants indicated that artistic/drawing ability is a factor that would influence the development of an infographic. Artistic and drawing ability as a factor influencing the development of infographics includes the concepts of:

- worry about drawing and overcoming fear of drawing (Jerry);

- struggles associated with getting from idea to paper (Becky), representing ideas accurately (Diane), and not knowing where to start (Tyler);

- difficulty creating symbols and diagrams (Adam);

- being outside of comfort zone (Frank, Tyler);

- not being able to draw, not knowing how to draw, struggle with drawing, not being good at drawing (Lisa, Tyler, Becky, Frank);

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- and the desire to make it [infographic] look good (Diane) because someone will be looking at drawings (Jerry).

Learning style/learner types. Learning style and learner types was identified by all of the participants except Frank. The perceptions of participants relating to the influence of learning style and/or learning types in the development of infographics include:

- infographics not for everybody (Natalie, Becky, Tyler);

- visual learners might respond better to infographics (Lisa, Becky, Natalie);

- traditional and non-traditional students might respond differently (Natalie, Tyler);

- ways people have been taught might influence (Adam);

- mindset, different type of learning (Jerry);

- some might not be open to trying (Tyler);

- and cultural aspects associated with students (Lisa).

Visualization ability. The ability to visualize concepts was mentioned by all of the participants except Tyler. Visualization ability as a factor in developing infographics is further influenced by the following visualization sub-themes:

- transforming an idea into a visualization (Jerry, Lisa, Becky, Frank, Diane);

- ability to visualizing things, visualizing concepts (Adam, Natalie, Lisa);

- picking the right visualization type (Jerry);

- and creating a visualization that would be meaningful to someone else (Frank, Adam, Becky).

Also related to visualization ability are the concepts of visual organization, visual design, visual layout, visual hierarchy, arrangement, sequencing, and organization

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(Adam, Becky). These responses were grouped with visualization ability because the responses provided most closely relate to the concept of visualization.

Two categories of secondary factors were mentioned by just over half of participants. Additional factors identified include understanding the content enough to develop an infographic, lack of understanding in how to develop an infographic, designing, organizing and sequencing an infographic, and selecting/coming up with a topic for an infographic. The secondary factors included:

- understanding content enough to develop and infographic (Adam, Becky, Diane, Jerry, Tyler);

- lack of understanding about how to develop an infographic (Adam, Becky, Lisa, Natalie, Tyler);

- design, layout, organizing, sequencing of infographic (Adam, Becky, Diane, Frank);

- and selecting/coming up with a topic for an infographic (Adam, Lisa, Natalie, Tyler).

Tertiary factors influencing the development of sketch-based infographics include creativity, knowing how to use the right data for infographics, concerns about using infographics with learning that may have visual disabilities, and the overall challenging nature of developing an infographic. The tertiary factors influencing development of infographics included:

- creativity (Adam, Lisa);

- using the right data (Becky, Jerry);

- visual disabilities (Adam, Diane, Tyler);

- and the overall challenging nature of the activity (Adam, Frank).

The most common factor mentioned influencing the development of infographics was artistic/drawing ability. All participants referenced the artistic/drawing aspect of the infographic development process as a factor influencing the development.

Infographic development skills and abilities. Participants identified twelve (12) skills perceived to be required for the development of infographics. Table 76 provides the skills identified and the participants that mentioned the particular skill.

Table 76

Skills and Abilities Required to Develop Infographics – Cohort Perspective

Skills Required to Develop Infographics	#	A	B	D	F	J	L	N	T
				Participant Comments					
Mastery, understanding of content	6	•		•	•	•		•	•
Ability to visualize, conceptualize and graphically represent concepts	4		•		•	•		•	
Creativity	2	•					•		
Basic art skills, abilities	2						•		•
Logic, deductive reasoning	2	•	•						
Research skills	2		•			•			
Open mind	2						•		•
Design skills	1		•						
Organization skills	1	•							
Teach to an audience	1		•						
Technology skills	1		•						
Not afraid to make mistakes	1							•	
No unique skill set	1			•					

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Figure 47 provides an infographic representing the major concepts associated with developing infographics.
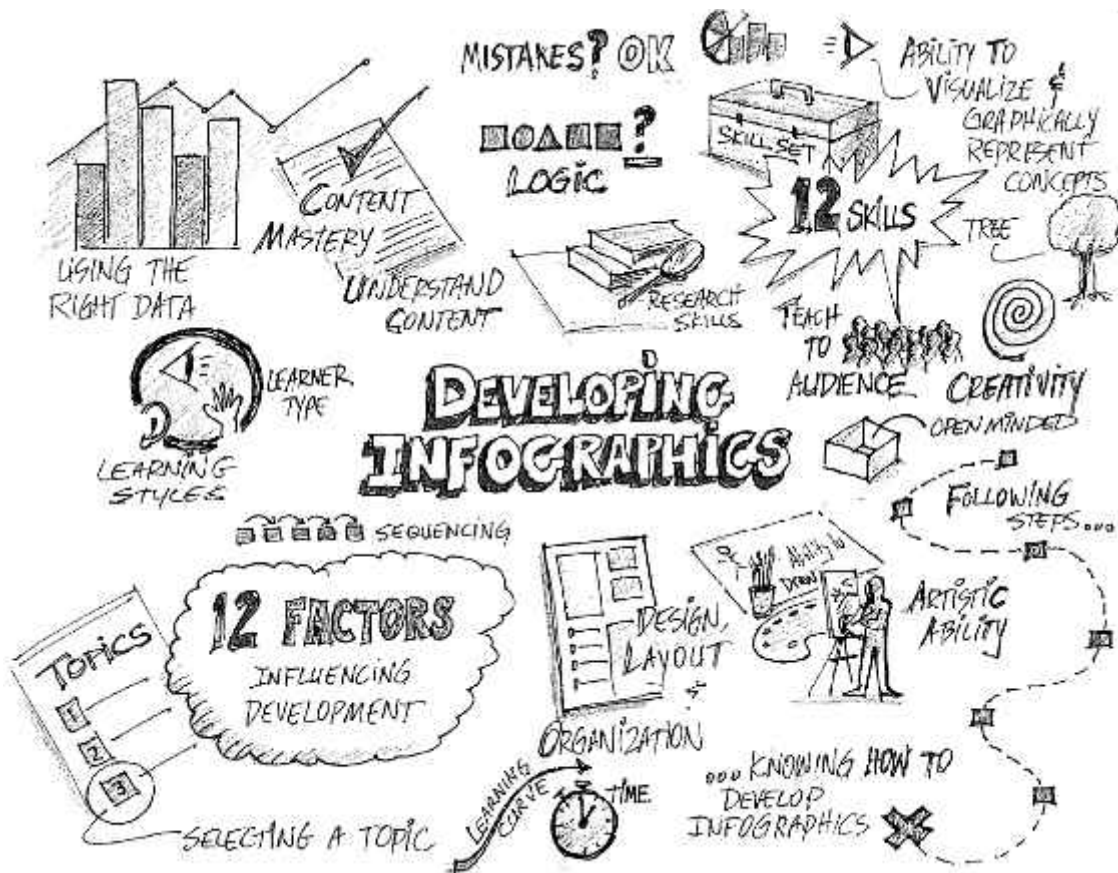
Figure 47. Developing infographics – cohort perspective. Infographic of concepts associated with developing infographics. Infographic depicts concepts participants shared associated with the process of developing infographics.

The two most commonly identified skills mentioned by the participants were mastery and understanding of content (6 participants) and the ability to visualize, conceptualize, and graphically represent concepts (4 participants).

Mastery and understanding of content. Adam, Jerry, Tyler, and Frank all had similar responses about the need to master and understand content in order to develop an infographic. Adam suggested, "You have to have good knowledge of the topic." Jerry offered, "Well the main thing is understanding your subject." Tyler said, "You need to have a pretty in-depth understanding of the content to begin to display it as an

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infographic." Frank added, "To visualize something to the extent to where you do an infographic; you've got to understand it pretty well already." Natalie stated, "This [infographic] would force them to actually show if they have an understanding." Diane reflected, "It would be pretty daunting for a student to try to create an image about something they don't really understand."

Ability to visualize and graphically represent concepts. Becky, Frank, Jerry and Natalie identified the ability to visualize, conceptualize and graphically represent concepts as a skill required to develop infographics. Frank's response summed up this idea.

> I think conceptualization probably would be number one and you know, people would assume their drawing skills first in looking at it, but it's really about being able to, big picture, you now, relating things to one another, interconnectedness, flow, whatever it is, being able to, to see it all in some way and then, once you can kind of see it all, then you've got to communicate what you see whether it's metaphorically so yeah that would be the, you'd have to be able to do that, and so understanding a concept or understanding content whatever is important, you've got to have that, but, then I think, it's another level beyond that to conceptualize it and maybe another level beyond that to put it in a form that others can see it, see what you've conceptualized, so yeah, it's talking about multi-level thinking. - Frank

Several of the skills identified are grouped under the visualization, conceptualization, and ability to graphically represent concepts. These are design skills (Becky), organization skills (Adam), and creativity (Adam, Lisa).

Becky also touched on a key skill being the ability to teach a concept to someone else.
Becky stated,

> Not really teaching skills, but I guess teaching skills in a way, I don't know what
> you would call that but just being able to relay information to someone else that's
> easily understood, having that ability to put yourself in the viewer's, you know,
> seat and think, you know what is it that I would like see, what is it I would like to
> get from this, and does this make sense to me, seeing there selves on the other
> side of it and then the design thing, you know, being able to design it.

Basic art skills and abilities, logic, and research skills, were also
mentioned by at least two participants. Lisa and Tyler both mentioned having an
open mind as a critical skill for developing infographics. Lisa said, "Definitely
some traits I think, you know creativity, openness, I mean, you know, they need
to have an open, open mind about it [using infographics]." Tyler did not think that
art skills and abilities were necessarily critical but he thought that being open to
sharing artwork with others would be required. Similarly, Lisa did not think
someone developing an infographic would need advanced art skills but would
need to be "open minded, willing, you know, willing to, you know, get in touch
with your creative side a little bit and being able to do the visual part." Natalie
suggests that not being afraid to make mistakes is a critical skill in developing
infographics stating, "I think, yeah, I think you just got to not be afraid to make
mistakes."

Sharing the experience – cohort thoughts. I asked participants if they would recommend infographics to other post-secondary educators and if so, what would they share with them about their experience. I was interested to find out what the participants thought about their own experience and how that might influence what they might tell their peers. All of the participants indicated that they would recommend the infographics training program to other post-secondary educators. What each would share is varied. The following provides a summary of those comments.

Adam said, "It makes you think about how you could utilize things and convey things to different learning styles because everybody's got different learning styles so this is just another avenue on how you can teach individuals, especially visual learners, pathway learners, people that learn by pathways, that's always a good thing." Lisa seemed to agree, "I think it opens our minds to other ways of teaching and student learning."

Adam, Becky, and Jerry highlighted the information presentation aspects of infographics indicating that infographics are a great way to present information to students. Adam described using infographics as "A concise, systematic approach to presenting information rather than long printed out PowerPoints or outline notes." Becky added, "It's just a great way to present a large amount of information and summarize it down really quickly for someone to gain knowledge from." Similarly Jerry describes that instructors can "Just show them [students] that you can give quick information like that [in infographic form] and let them understand it."

Becky said the "students need this kind of thing." Diane also wanted to share "how fun, and easy, and effective it can be." Diane and Lisa viewed infographics as a

great way to evaluate learning. Diane pointed out that "It's a great way to evaluate your student getting the big picture about something in an efficient way that's easy to grade." Similarly, Lisa added, "it's another way of assessing grades, another way of measuring learning, and another way of communicating what, what they're learning in class."

Diane also touched on another aspect that she wanted to share involving the impact of infographics on the classroom environment. Diane stated,

"It [infographics developed as a group] stimulates the kind of social environment that you know, where students just thrive I think. It makes them more comfortable with you, and more comfortable with their group members…I avoid those words because they get used so often that they don't mean anything but engagement, it engages, causes students to be engaged with or engage with the material."

Diane, Jerry, and Natalie touched on how the infographics training provided a way to change up instruction, to provide variety, to do something differently. Diane described how someone could use infographics, "You could do this everday, I mean, I don't know if you would do it everyday because you want to change it up so it's interesting, but you could do it regularly with every big, new topic. " Jerry thought that "It just offers up some more opportunities for you to provide instruction." Natalie described the infographic training experience "it was just completely different, it was a completely different training."

Tyler shared,

There's a lot more to it than just making a pretty picture, right, that's kind of the idea that I would want to get across to other people. Because everyone sees the

nice publishable ones, and it's, it's more to it than that. It can be applicable in different, a lot of different ways.

Plans for infographic use. After listening to what the participants had to say about their experience developing infographics I wanted to know if they were planning on using infographics in their classes. All of the participants indicated that they were planning on using infographics or at least try to find a way to use them in their classes. Most of the participants including Adam, Becky, Frank, Jerry, Lisa, and Natalie already had specific ideas about how they were going to incorporate them into their classes.

Adam indicated that he was going to ask his students to complete an infographic regarding the documentation needs within his program. Becky said that she was going to develop an infographic-based syllabus and have the students develop their own infographic syllabus. Frank was going to use infographics to assist students with the writing process associated with rhetorical analysis assignments. Jerry was going to promote the use of infographics as a way to communicate more statistical information. Lisa indicated that she would like to use an infographic as part of her critical thinking assignments. Natalie, like Becky was going to develop an infographic-based syllabus and is considering the use of infographics in the practicum courses within her program.

Diane and Tyler indicated that they were going to use infographics in their classes but did not have a specific application for them yet. Tyler indicated,

> At this point, that's what it would be, it would be just kind of going through the course again, and, and really taking it, as I teach it, and thinking about having this in the back of my head when I could use this next time, or if it's something that's coming up I can use it you know.

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Need for infographics. Throughout the interviews participants shared issues associated with the need for assignments like infographics. Table 77 provides an overview of the comments shared by participants describing the teaching environment, student characteristics, characteristics of post-secondary education and the link between infographics and these issues.

Table 77

Cohort Thoughts about the Need for Infographics

Thoughts about the need for infographics	#	A	B	D	F	J	L	N	T
Students not asked to be creative; come up with things on their own; lack of imagination	5	•	•	•				•	•
Going to see more infographics/more visual environment	4	•		•	•	•			
Students bored with traditional methods; want changes in ways classes delivered	3		•	•				•	
Students are getting information differently; generation of students seeing more streamlined information	3	•				•	•		
Culture is changing; need to change culture of teaching	2					•		•	
Students are different	2	•						•	
Real need for it (infographics); Students need this kind of thing	2		•					•	
Students need skills in planning, sequencing; distilling information	2	•					•		
Need to teach differently	1							•	
Students would see infographics as something new/fun	1					•			
Infographics stimulate engagement better than lecture	1				•				
Students don't really know what they need to know	1							•	
Students aren't challenged enough	1	•							
Infographics force students to think	1						•		
Information overload; students today are overwhelmed with information	1		•						
Students like visual things	1	•							
Students seeking the cool factor	1		•						

Note(s): # = number of participants mentioning a concept. Column headings A, B, D, F, J, L, N, T represent the first initial of the participant names as follows: A = Adam, B = Becky, D = Diane, F = Frank, J = Jerry, L = Lisa, N = Natalie, T = Tyler.

Participants thought that students were not challenged to be creative (Adam, Becky, Diane, Natalie). Some thought that students were uninterested with traditional

teaching methods; wanting changes in the way classes are delivered (Becky, Diane, Natalie). Natalie and Becky thought that students needed activities like infographics. Some thought that students would see infographics as something novel and innovative (Frank, Becky). Additionally, infographics encourage thinking (Jerry) and provide a way to engage students not possible with traditional techniques such as lectures (Diane) Participants recognized that students are different in the classrooms of today (Adam, Natalie) precipitating a need to teach differently (Natalie, Jerry, Frank) and to change the culture of education to meet the needs and provide expectations for a new generation of students (Natalie). Participants suggested that students like visuals (Adam), pointing out that infographics and other visualizations are becoming more pervasive in our society (Adam, Diane, Frank, Jerry) promoting different, more visual ways for students to obtain information (Adam, Frank, Jerry). Becky points out that students today suffer from having access to enormous amounts of information. To deal with this volume of information, students need skills in planning and sequencing (Adam) information and skills in condensing and distilling information (Lisa).

CHAPTER FIVE

DISCUSSION AND IMPLICATIONS

Introduction

In this chapter, I will discuss the results and findings of this study in terms of the research questions and explore implications for practice, policy, and future research associated with infographics in post-secondary education. The purpose of this qualitative study was to explore the phenomenon of infographics in a post-secondary learning environment to determine the perceived impacts, influences, and contributions of infographics to the educational and assessment process and to develop a research-based model for educational application and teacher training. This study also sought to explore the experiences, perceptions, and characteristics of post-secondary teachers exposed to infographics concepts, explore uses for infographics in post-secondary educational contexts, identify factors that promote or inhibit pedagogical application of infographics as a learning and alternative assessment strategy, and examine the educational training, support, and development environment associated with infographics.

Research questions. The research questions for this study have been answered with the findings presented in Chapter 4 and in the discussion, implications, and conclusions presented in this chapter. The research questions for this study:

1. How do post-secondary teachers perceive, make sense of, and understand the infographics training experience?

   a. How can infographics be utilized in post-secondary educational contexts?

2. What do post-secondary teachers perceive to be factors that facilitate and barriers that impede the use of infographics as a form of alternative assessment in post-

secondary learning environments?

    a. What constitutes an educational environment that is conducive for and
supportive of infographic application in post-secondary educational
contexts?

3. What do post-secondary teachers perceive to be the skills development, training,
and support needs associated with implementation of infographic-based
assessments?

The research questions of this study are answered within each of the themes and
therefore are not exclusively tied to one theme and are included in the sections that
follow. To simplify reporting, I have listed research questions with the most applicable
theme but ask the reader to keep in mind that all of the research questions are addressed
at some level in each thematic description. The themes emergent from the study which
are graphically represented in Figure 48 encompass the overall perceptions and
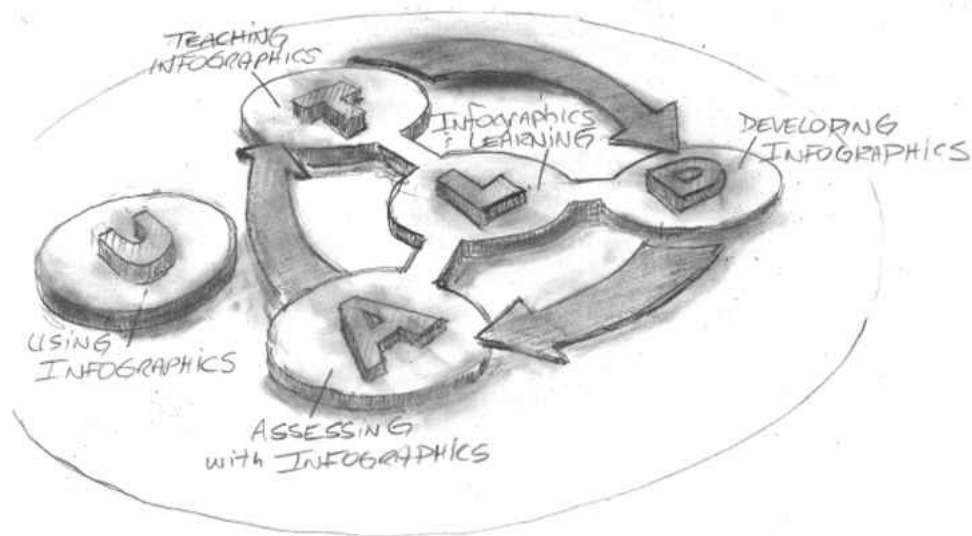experiences shared by the participants of this study.

Figure 48. Major concepts of study. The figure depicts the interconnected nature of the five major themes of this study – Using Infographics, Teaching Infographics, Developing Infographics, Assessing Infographics, and Infographics and Learning.

This study revealed five (5) major themes associated with the use of infographics as alternative assessment in post-secondary education. These five interconnected themes include Using Infographics, Teaching Infographics, Developing Infographics, Assessing with Infographics and Infographics and Learning.

The theme *Using Infographics* explores participant thoughts about how infographics might be used and describes factors that influence the use of infographics in post-secondary education. The theme *Teaching Infographics* reveals thoughts and perceptions from participants about the instructional aspects associated with teaching students how to use infographics and explores conducive educational and support environment suggestions. The theme *Developing Infographics* provides insight into the skills, abilities, and processes needed to develop an infographic and addresses factors that influence infographic development. The theme *Assessing with Infographics* describes benefits, challenges, and strategies associated with using infographics as an assessment of

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learning. Finally, the theme *Infographics and Learning* provides the learning outcomes and influences associated with an infographics activity. In subsequent sections the relationship and interconnections between these themes are more thoroughly described and include the practice and policy implications associated with infographics in post-secondary education.

One of the goals of this study has been to provide a resource for implementing infographics in post-secondary education. Although these resources are compiled from a small sample of post-secondary educators, I believe that the information can provide additional insight and clarity into this non-traditional form of instruction and assessment. I hope that by reading these shared experiences, the reader will come away with a better understanding about infographics and have a resource that can help guide them through the process of implementing an infographic or similar assignment in their own classes.

This study contributes to extant research by exploring alternative, visual, instructional approaches prescribed by Gallicano, et al., (2014) and reflects insight into assessments that provide students with alternative means of demonstrating learning (Sanders, 2001). Participants of this study have shared their experiences and perceptions about use of infographics in educational settings as recommended by Howes and Stevenson (2013) and Gallicano et al., (2014) and explored possible uses for engaging next generation (Lamb & Johnson, 2014b) and non-traditional learners (Hay et al., 2010) along with evaluating the use of infographics as a means to visually impact teaching as suggested by Gallicano, et al. (2014). Further, this research has focused on teacher perspectives throughout the infographic training experience providing insights and thoughts about how this specific alternative form of assessment may impact learning as

prescribed by Offerdahl and Tomanek (2011) and has explored applicability of infographic use in education (Howes & Stevenson, 2013) and specifically in higher education settings as suggest by Sanders (2001). Even though participants of this study were post-secondary teachers, they experienced the infographic development process as students therefore also providing a student perspective as recommended by Offerdahl and Tomanek (2011).

The finding and conclusions of this research help to building the knowledge base about new, alternative forms of assessment and how these forms can capture, reveal, and monitor learning, meeting the need identified by Buhagiar (2007), Purnell (1999), Schafer and Moody (2004), and Sparapini (2000). This study has responded to the call of Corcoran et al. (2004) by exploring creative alternative assessment applications in post-secondary education. Further, this study has explored a creative approach to assessment echoing the educational benefits suggested by Tepper (2004) and analyzed the impacts of alternative and creative assessments to the learning process as recommended by Hay, et al. (2010).

This study contributes and informs instructional and learning environment considerations by examining the structure and support necessary to facilitate the use of alternative assessments as proposed by Buhagiar (2007) and exploring specific use of infographics in the instructional strategy (Howes & Stevenson, 2013) and analyzed the use of alternative assessment approaches in higher-education contexts (Hay, et al., 2010). Participants in this study have shared their perceptions of how visualization techniques such as with infographics can be applied to the instructional process meeting the need

identified by Callow (2005), Callow (2006), Rosier and Dyer (2010), Search (2009), and Reyes (2011).

The responses from participants in this study confirm suggestions by Brown (2014), Cano (2011), and Gallicano et al., (2014) regarding the need for additional training with skills associated with the visual communication of information. The additional training required along with time for practice necessary to develop skills in distilling ideas and concepts identified in this research supports recommendations from Brown (2014). Teacher training and skill development revealed in this study reflect a similar finding from Allen and Flippo (2002). In addition, this study supports the recommendation of Silverman and Piedmont (2016) who suggest that training and support for students developing content to convey information visually is lacking.

The Infographic Development Experience

The coding and analysis process described in Chapter 3 and the findings of the research presented in Chapter 4 have coalesced into the graphic shown in Figure 49. Utilizing principles taught in this study's infographic training, I have utilized a sketched infographic to represent the interpretation and conclusions of this study. I propose the model to encapsulate and edify the participant experiences shared as part of this study. Figure 49 also serves as my interpretation of a possible prescriptive application framework for using infographics in post-secondary educational environments based on the insights, perceptions and thoughts shared by the participants of this study.
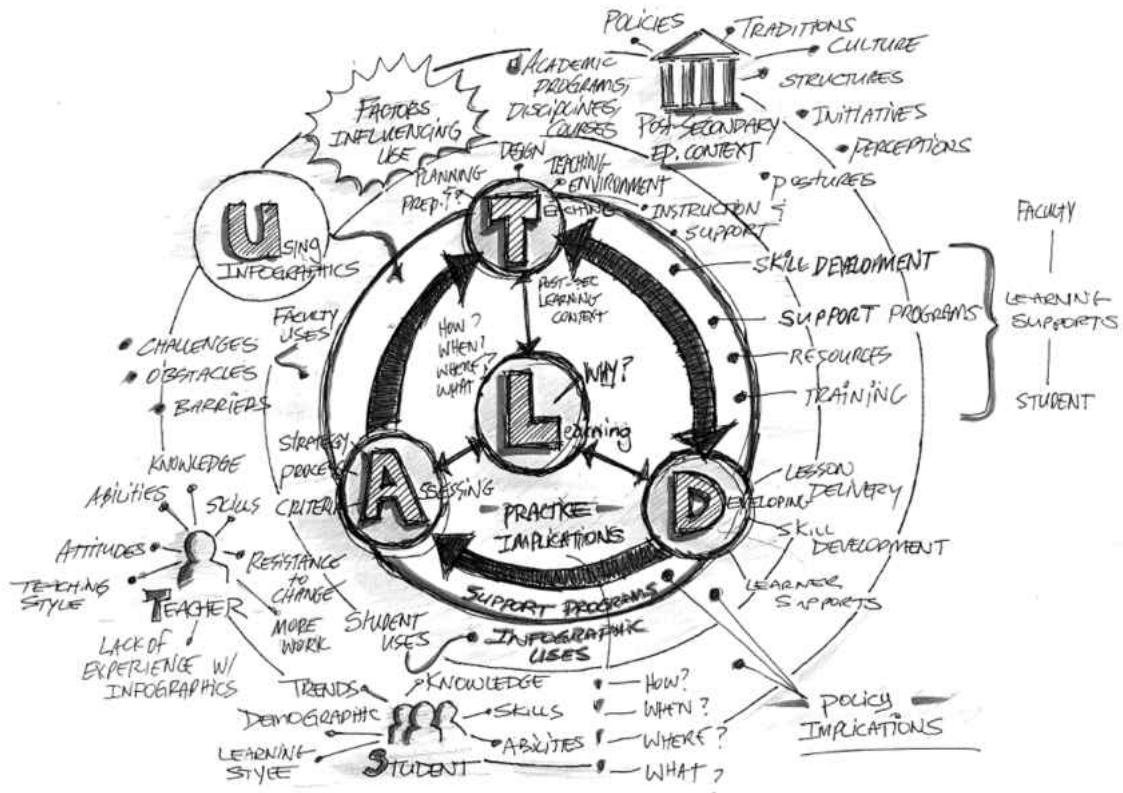
Figure 49. The infographic development experience in post-secondary education. Practice and policy implications of using infographics in post-secondary education

Research question - How do post-secondary teachers perceive, make sense of, and understand the infographics training experience? How can infographics be utilized in post-secondary educational contexts?

I offer that the pedagogical application of infographics in post-secondary educational contexts begins with an awareness and understanding of the potential uses for infographics and the thoughtful consideration of factors that influence the use of infographics in post-secondary education. Chapter Four presented a variety of teacher and student uses for infographics. Participants shared that the use of infographics is influenced by several factors. These influencing factors encompass the post-secondary educational context and included teacher-, student-, course/subject-, assessment specific-,

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and institutional/programmatic considerations. Table 78 provides a summary of these considerations. These considerations are presented without notation regarding the frequency of response or participant information. The intent of this presentation is to provide a resource and reference for teachers considering implementation of infographics.

Table 78

Factors Perceived to Influence Use of Infographics

Skill factors
☐ Artistic/drawing skills and abilities
☐ Visualization skills and abilities
☐ Design, layout, organization skills and abilities
☐ Creativity skills and abilities
Teacher factors
☐ Learning curve, extra work, time involved
☐ Teacher not open to trying something new
☐ Resistant to changing method of teaching; teaching style
☐ Understanding content enough to develop infographic
☐ Following steps/process/knowing how to develop an infographic
☐ Teacher resistance (general)
☐ Resistant/hesitant to change
☐ Time factors associated with infographics
☐ Time away from other content; having to work in
☐ Moving away from lecture
☐ Time and effort required, payoff worth investment
☐ Extra work
☐ May not see benefit/value
☐ Instructor attitude/culture of post-secondary education
☐ Instructor personal bias/preferences/teach way they want to learn
☐ Harder than normal instruction
☐ Instructor understanding of infographics
☐ Difficulty determining best fit in particular class
☐ Challenge to teaching abilities
☐ Challenging to develop lesson in a way that makes sense
☐ Challenges perceptions about current teaching
☐ Concept unfamiliar to teachers, limited experience with
☐ Perception that infographics might be childish
☐ Instructor knowledge of subject
☐ Teacher adoption
☐ Costs associated with materials for infographics

Table 78 (continued)

Factors Perceived to Influence Use of Infographics

Student factors
☐ Learning style/Learner types
☐ Understanding content enough to develop infographic
☐ Following steps/process/knowing how to develop an infographic
☐ Resistance from learners (general)
☐ Selecting/coming up with a topic
☐ Learners unfamiliar with infographics
☐ Visual impairments, disabilities, ADA
☐ Selecting and using the right data for infographic
☐ Learners may not grasp concept as easily
☐ Student population, types of students
☐ Additional stressor
Assessment factors
☐ Factors associated with grading (general)
☐ Concerns about rubric for grading
☐ Instructor interpreting student visuals
☐ How to grade fairly
☐ Wide-open on how to assess; subjectivity of grading
☐ Placing too much emphasis
☐ How to grade art
☐ Grader bias/preferences
Curriculum/program/class factors
☐ Curriculum/program restrictions, common courses, common assessment; academic freedom
☐ Differences by discipline/class type, assignment type
☐ Difficulty determining best fit in particular class

A decision to use infographics in post-secondary educational contexts should be informed by careful analysis and reflection about each of the aforementioned factors and considered carefully before selecting an infographics application. This study identified several uses for infographics in post-secondary education. Table 79 provides a listing of these potential uses.

Table 79

Using Infographics in Post-Secondary Education

Instructor Use
☐ Instructor notes, presenting, communicating information; lecture supplement
☐ Assessment
☐ Syllabus
☐ Course planning, organization, outline, prep
Student Use
☐ Student notetaking
☐ Storyboarding
☐ Study guide/study strategy
Assignment-Related Use
☐ Alternative/optional assignment/supplemental activity
☐ Projects
☐ Critical thinking assignment
☐ Enhance the reading experience
☐ Flipped classroom assignment
☐ Portfolio
☐ Design practice
☐ Conceptualize a topic
☐ Student presentations
☐ Resume
Other Uses
☐ Student recruitment
☐ Administrative communication
☐ Undecided about use

The decision to utilize infographics is multifaceted and contingent upon an authentic and thorough examination of the intended educational application of infographics, the subject/class where the infographic is being considered for use, the commitments and skills necessary to teach infographics, the classroom implications, the intended student impacts and outcomes, and the programmatic and/or institutional posture regarding utilization of non-traditional, alternative instruction or assessment.

A synergistic cycle of learning. Reseach question 1 - How do post-secondary teachers perceive, make sense of, and understand the infographics training experience?

Once a decision has been made to utilize infographics I suggest that a synergetic

cycle of phases begins as illustrated in Figure 49. These phases are based upon the

themes emergent from this study and include the teaching of infographics, the

development of infographics, and ultimately, the assessment of infographics. Each of

these thematic phases is connected to and influences learning. Learning apparently takes

place from the completion of the cycle but also occurs with each phase of the cycle.

Learning seems to be occurring during the teaching phase, the development phase, and

the assessment phase. Some of this learning is associated with the teacher; some is

associated with the learner. Throughout the study participants commented about how the

use of infographics benefits learning associated with the student and the teacher. Table 80

provides an overview of the learning benefits that were suggested by the participants of

this study.

Table 80

Infographic's Impact to Learning

☐ Better, more in-depth understanding; perspective
- Infographics as a teaching activity (teach to learn, learn to teach); being able to communicate understanding
- Encourages thought, deeper thought; rethinking
- Valuable for students to go through process; finding a way to learn
- More meaningful learning
- Useful tool
☐ Promotes critical thought, higher-level thinking, critical analysis
- Big picture thinking
☐ Find connections in content, conceptualize a topic, identify patterns
☐ Reinforces learning; retention and recall; memory/study aid
- Faster way to learn
- Great way to learn, helpful;
- Students would love this
- Impacts learning
- Promotes organizational skills
- Offset limited reading skills
☐ Promotes visualization skills; visually communicate understanding
- Provides way to visualize learning
☐ Requires accurate information/information checking/vetting/research skills
☐ Something different, another form of learning, open our minds to new ways; cutting edge way to make class better; way to challenge students
- Fosters creativity, imagination
- Opportunity for discovery; see the story develop; see learning represented; provides way to visualize learning
- Stimulates engagement; encourages attention; student connect with this more
- Another form of learning
- Fun factor
- Way to make classes better
- Encourages flexibility in learning
- Stimulates social environment conducive for learning
- Lots of information in a small area/condensing/organizing
- Helpful to teachers; – informs instruction; sensitive to learner needs
☐ Meets needs of different learning styles; learner needs; address learner anxiety

The process of infographic development contributes to positive learning outcomes, promotes visualization skills, and can positively influence the learning environment. In addition, the processes of teaching, developing and assessing infographics collectively contribute to and fuel the learning of both student and teacher. I believe that assessment of learning is happening at each phase of the infographic development cycle described in the study. As we are teaching students how to develop

infographics, learning is taking place, students are learning as they develop infographics, and as we assess infographics, we are learning. Students are learning about the subjects and topics of the infographics, we as teachers are learning how to alter and adapt instruction to improve student learning. Infographics can help to encourage more in-depth understanding from our students, promoting critical thought, critical analysis, and higher-level thinking. Infographics can help students find connections and patterns in content, reinforce learning, improve retention and recall, and help develop visualization skills necessary to visually communicate understanding. Infographics can also foster improvements in research skills, engage different learning styles, and introduce a different form of learning, opening minds to new ways of learning and provide an avenue to challenge students in a positive and meaningful way.

This study has revealed additional information as to how infographics benefit the learning process building upon the work of Cifci (2016), Howes & Stevenson (2013), Virag (2013) and Zuk (2011) and elaborated on how using infographics provides opportunities for students to demonstrate learning (Abilock & Williams, 2014). This research supports findings by Toth (2013), Howes and Stevenson (2013) and Simiklas (2012) regarding the knowledge required to visually represent understanding. In addition, finding of this study support Howes and Stevenson (2013) describing the benefits associated with promoting creativity and autonomy of learning, Abilock and Williams (2014) regarding the benefits of unrestricted thoughtful exploration, and Gallicano et al. (2014) regarding the benefits associated with capturing how learners perceive a topic or issue. This research also supports Toth's (2013) findings regarding the enjoyment of learners realized associated with being immersed and involved with the process of

developing infographics and supports Davidson (2014), Gallicano et al. (2014) and Toth's (2013) suggestions associated with an infographic's ability to engage, involve, and capture the attention of learners.

Improved understanding. Infographics may help to encourage deeper thought, facilitate more meaningful learning, and provide an effective and useful tool for students as they explore a new topic or subject. Developing an infographic requires understanding to the point where it can be effectively communicated to others, in essence teaching content to someone else. If the process of developing an infographic is similar to teaching, as was described in the study, then students would need to have a good grasp of the material in order to effectively relay the information in an infographic. Use of infographics also helps to promote critical thought and analysis, engages higher-level, big-picture thinking thus helping students discover and recognize connections and patterns in content.

Reinforcement of learning. Infographics are a great way for students to learn and help reinforce the concepts being taught. Going through the process of developing an infographic may help students retain and recall the material providing them with a memory and/or study aid. Infographics may also help to promote organization skills and in some cases could offset reading skill limitations of students. Infographics can promote visualization skills by requiring visual communication of understanding and a graphical depiction of student learning.

Something new and different. In many cases, infographics is something new and different to both students and teachers. Infographics provide teachers with a way to cultivate and promote the creativity and imagination of students providing them with

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opportunities for discovery; to see their learning unfold and be represented as a visual story. Infographics stimulate and engage students in a way that is fun and in a way that makes classroom environments more conducive for learning. Using infographics also helps to encourage flexibility in learning and can be helpful for teachers by informing instruction.

Conducive and supportive educational environment. Research question - What constitutes an educational environment that is conducive for and supportive of infographic application in post-secondary educational contexts?

Research question - What do post-secondary teachers perceive to be the skills development, training, and support needs associated with implementation of infographic-based assessments?

I offer that the teaching of infographics requires an instructional approach and outlook different from that associated with traditional forms of post-secondary instruction. The comments made by participants that coalesced into the theme of teaching infographics reveal a prescriptive model for teaching infographics. This structure for teaching infographics was divided into three (3) phases of teaching infographics. These phases of teaching infographics include a planning and preparation phase, a lesson design phase, and a lesson delivery phase. Each of these phases contributes to the skills, approaches, and instructional practices that could be employed to facilitate the development of an infographic.

Planning and preparation. This study supports Sparapani's (2000) suggestions requiring the instructor of an alternative form of assessment to think differently about the learning objectives and the learning strategies employed. The planning and preparation

phase includes an analysis of the intended utilization in the instructional strategy. This phase of application reflects some of the same considerations associated with the previous theme of the model – Using Infographics. At this point in the teaching phase, teachers consider the placement of the infographic activity within the larger instructional strategy for a course. Additionally, teachers explore and acknowledge instructional tendencies and patterns and consider the characteristics of the infographic lesson, develop and/or employ skills necessary for teaching infographics and adopt or embrace teaching characteristics and attitudes required for the activity (ies). At this phase of teaching, teachers would be deciding on how to use infographics in their courses, and decide how the activity will best fit within existing lesson plans. The planning and preparation phase may also require additional training on the part of the teacher. Additional infographics development training and/or skill development associated with teaching and/or developing infographics would positively influence subsequent phases within the *Teaching Infographics* phase and throughout the complete training cycle. The planning and preparatory phase could last a considerable amount of time as teachers familiarize themselves with the infographic and determing the best use in specific courses. As was pointed out in the findings, the infographic is different than some of the traditional instructional activities being utilized and therefore might require additional preparation prior to implementation. As suggested by the participants, a phased implementation and/or gradual approach may be a good way for teachers to try out this instructional activity. An evolution of the activity within the existing overall instructional strategy might be best, particularly for those teachers that are not naturally inclined to utilize constructive and/or information visualization instructional activities. The planning and

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preparation phase can potentially help teachers explore the many different aspects of

infographics and determine the optimum form of implementation based on the specific

teaching style and teaching skill set. Prior to teaching infographics teachers should learn

more about infographics, carefully consider the teaching approaches associated with

teaching infographics, and develop plans for using infographics. A summary of the

planning and preparation considerations are included in Table 81.

Table 81

Planning and Preparing to Teach Infographics

☐   Start small, build up; simpler infographics; limited use
☐   Additional infographics training
☐   Teacher should understand how to develop an infographic
☐   Time for learning/dealing with the learning curve
☐   Demonstrate use; Introduce on syllabus; or other instructor provided examples
☐   Commit to planning and developing infographic components; commit to use
☐   Realize that if may not go well the first time
☐   Develop a library/repository of infographic samples
☐   Take more than one semester, over a period of time; multiple phases/steps
☐   Being able to adapt to new way of teaching; modify teaching approach
☐   Willing to be creative
☐   Approach with an open-mind
☐   Needs to be modeled throughout course
☐   Should be a significant part of course; commit to use
☐   Introduce early in the semester
☐   Don't be afraid to make mistakes
☐   Pick the right course/topic
☐   Use in multiple classes
☐   Class time devoted to infographic training
☐   Collaborate with other teachers
☐   Read books about infographics
☐   Going to take some time, accept that it is not going to be easy at first
☐   Evaluate how to adjust existing class to accommodate the time needed for infographics

Learn more about infographics. First and foremost, teachers interested in using infographics in their classes should have a good understanding about how infographics are developed and have at least some experience developing an infographic. To learn more about how to develop infographics teachers could explore online infographic resources, read books about infographics, and participate in additional training for developing infographics. Further, additional training related to the components that make up the infographic could be explored. This training might include topics such as information visualization, visual communication, visual literacy, and graphic design. A review of popular online infographics resources could also help to improve a teacher's understanding about infographics and provide examples of the use of infographics in a variety of contexts. Additional practice with designing infographics will help to improve the teacher's familiarity with the visual communication form and provide a solid foundation for utilizing infographics. Development of a library or repository of infographic samples could also be utilized to help teachers develop and utilize their own infographics as part of an instructional strategy. Seeking assistance from other teachers who are using infographics could also yield additional insight into how infographics are taught and utilized.

Consider teaching approach. Teaching infographics requires an instructional approach that is very different than that used with traditional instructional methods. Teachers should be capable of and receptive to a new way of teaching and be prepared and comfortable modifying their teaching approaches. Teaching infographics may not be easy, is going to take some time to get used to, and may not go well the first time it is attempted. It is imperative that teachers approach using infographics with an open mind,

allow themselves to be creative and not be afraid of making mistakes. Learning infographics and learning to teach infographics is going to take some time.

Plan for use. The decision to use infographics in post-secondary education requires a thorough and thoughtful analysis and plan for implementation. Teachers interested in using infographics as part of their instructional strategy should carefully consider the course and/or topic for the infographic. Selecting the right course and/or topic is a critical decision. As reported in this study, the use of infographics is influenced by the type of course or subject being taught. Once the course and/or topic is selected, teachers should commit to using infographics and incorporate infographics as a significant part of the course. As part of this process, teachers should evaluate and determine how to adjust an existing course to accommodate the extra time needed for an infographics activity. It has also been suggested herein that teachers should gradually introduce infographics assignments in phases or steps over the course of multiple semesters starting with limited use of smaller, simpler infographic assignments progressing to larger, more challenging infographics. It is suggested that if infographics are going to be used in a course, they should be introduced early in the semester with sufficient class time devoted to instructing students on how to develop infographics. Additionally, teachers should plan to demonstrate and model the use of infographics throughout the course introducing the concept using course components such as the syllabus and instructor provided examples.

It should also be noted that this study revealed several uses for infographics (Table 79). Some of these activities would require instruction whether or not infographics was being used specifically as an instructional activity. For example, if a teacher wanted

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students to utilize infographics as part of a note-taking strategy, the teacher would still be required to instruct students on how infographics are developed. It could be that in this example students would not turn in their notes but they would require instruction on how to take notes using infographics. In another example, perhaps a teacher decided that they were not going to use infographics as a student activity but instead wanted to use infographics as a teaching supplement or teacher notes. The teacher would still need to fulfill the planning and preparation phase in order to have the skills necessary to utilize the infographic to meet their need. I think that regardless of the application of the infographic, it is important that teachers complete the planning and preparation phase.

Infographic lesson design. Once the planning and preparation activities have been completed, the teacher can move to the next phase of the process, designing the infographic lesson. Table 82 provides a prescriptive approach and suggestions from participants about how teachers might design an infographic lesson. Participant suggestions regarding the design of an infographic lesson parallels the observations by Sparapani (2000) and Zeigler and Montplaisir (2012) associated with the additional time needed to design instructional activities and the additional time needed to implement those activities in class. The instructional activities suggested by the study participants associated with infographics confirms Zeigler and Montplaisir's (2012) observations regarding the additional instructional needs of students linked with alternative forms of assessment.

Table 82

Designing an Infographics Lesson

☐ Use a process, model, step-by-step approach
☐ Allow for practice time, multiple opportunities
☐ Important how infographics are introduced; highlight benefit and value
☐ Allow for revision, flexibility, freedom to create
☐ Make it fun
☐ Provide time for practice
☐ Start out with smaller or simpler infographics
☐ Use a common activity with a familiar topic
☐ Provide clear instructions
☐ Be mindful of time given for assignment
☐ Set clear goals and communicate those goals
☐ Avoid the theoretical side
☐ Should follow an instructional activity; preliminary assignment; lecture
☐ Realize learning something new may be overwhelming
☐ Realize that everyone may not know how to develop an infographic
☐ Determine the appropriate level of assignment complexity
☐ Determine whether to provide data or have student research
☐ Challenge students
☐ Be mindful of student knowledge base
☐ Delay sketching until later (if using a sketch-based approach)

Many of these concepts emerged from participant discussion around challenges that they experienced developing their own infographics. Participants shared examples of how one might design an infographic lesson indicating that the process would be based upon thoughtful consideration of and designed to meet the learner needs. The inherent characteristics of the infographic discussed by the participants during the study have informed these infographic lesson design suggestions.

When designing an infographic lesson, teachers should consider how the infographics activity will be introduced to students. The infographic activity should follow an instructional activity such as a lecture or preliminary assignment taking into

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consideration the knowledge base of the learner pertaining to the subject and/or topic of the infographic lesson. The lesson design should also take into account that learning something new can be overwhelming and teachers should understand that infographics might be new to students, thus, the level of complexity for the infographic assignment should be carefully considered. When starting with infographics it is recommended that teachers use some form of process or model that utilizes a step-by-step approach that is supplemented with clear assignment goals and instructions. Initial infographic assignments should utilize or require smaller or simpler infographics and be based on a common activity or utilize a topic that is already familiar to the student. The design of the lesson should be challenging but fun, and structured so that learners have sufficient time for practice and revision and provide the latitude for flexibility and empower the student with the freedom to be creative. Teachers should also determine whether to provide students with the data for the infographic or let them research the data for use in the infographic.

Designing an infographic lesson would seem to require an understanding about the learner, include a high level of clarity in communicating the assignment requirements and constructing the activity to match the desired learning outcomes, learner characteristics, and learner skill levels. At this point the teacher has planned and designed an infographic lesson and is prepared to teach the skill to others.

Instructing and supporting an infographics lesson. Delivering the infographic lesson involves the activities and practices associated with teaching the infographic lesson as designed in the previous step. This phase also includes the instructional support activities necessary to help someone learn how to develop an infographic. As was pointed

out in the study, the infographic is a different type of lesson, requiring different teaching

skills, enhanced supporting for the learner and connection to support resources. Table 83

provides a summary of considerations for delivering and supporting infographic

instruction.

Table 83

Instructing and Supporting an Infographics Lesson

- ☐ Provide examples/samples of infographics
- ☐ Use groups
- ☐ Address concerns students may have with sketching/drawing; explain role of drawing/sketching
- ☐ Demonstrate, provide examples, work along with students
- ☐ Provide tools, resources, cool stuff
- ☐ Show examples, samples, early design sketches of infographics
- ☐ Provide students with design template, design options
- ☐ Be available for students
- ☐ Delay judgment; don't expect perfection; give learners permission to screw up
- ☐ Practice what you preach; instructor use of infographics
- ☐ Be ready with ideas; help with visualization; design choices
- ☐ Teacher participation/involvement/support
- ☐ Develop training videos, webcasts
- ☐ Don't move too quickly; spend some time
- ☐ Use technology/internet/images/clip art
- ☐ Be up front about time commitment
- ☐ Start with a group assignment; individual assignment later
- ☐ Be patient and supportive
- ☐ Help learner develop topic for infographic
- ☐ Provide technology training for those that would like to use technology tools
- ☐ Provide visual layout and organization assistance
- ☐ Use labels to offset drawing limitations; written portion to explain
- ☐ Provide help selecting/refining information
- ☐ Incorporate peer reviews
- ☐ Bring in a trainer to assist
- ☐ Inform students up front about materials needed
- ☐ An infographics about infographics
- ☐ Drawing practice/training
- ☐ Develop a non-threatening learning environment

Once the infographic lesson has been designed, it is taught. It should be noted, that the actions of teaching and developing infographics might occur simultaneously resulting in a blending of the two activities into indistinguishable components. Delivery of the infographic lesson and the design of the lesson are iterative processes, each informing the other. As the teaching of infographics commences, the learning process has the potential to inform the lesson design which therefore may change or adjust the lesson delivery.

An optimum learning environment. This study has offered suggestions regarding the learning environment conducive for teaching infographics supporting the call by Buhagiar (2007). These suggestions are included in Tables 67 and 68. Infographics should be taught in environments conducive for creative and unconstrained learning. Teachers interested in teaching infographics should strive to develop non-threatening learning postures and cultivate learning environments that delay judgement of student work and endeavor to promote challenging and constructive activities. Infographic learning environments should also accommodate and provide latitude for student creativity. In addition, teachers should actively provide guidance and support throughout the learning process and be patient with the learner throughout the process. Participant responses associated with supporting learners confirms and addresses Sparapani's (2000) recognition of the potential lack of or limitations associated with support resources for activities involving higher-level thinking. Teaching the infographic to students requires careful attention to lesson timing and pacing in order to provide students with sufficient time to learn the concept of the infographic. Table 84 provides an overview of materials and resources the participants of the study suggested.

Table 84

Resources for Infographics Activities

☐ Individual white boards/dry-erase boards
☐ Highlighters, markers, pens, pencils
☐ Training packet, infographic development model
☐ Paper
☐ Books, resources
☐ Foster a creative atmosphere
☐ Document camera and projection system
☐ Sticky pads
☐ Materials (non-specific)
☐ Videos

Instructor use of infographics. Instructor use of infographics during the teaching process could also be an important aspect of infographic instruction. Participants of this study emphasized that teachers should demonstrate the use of infographics, use infographics as part of instruction, and provide students with examples and samples of infographics in various stages of development. Utilizing infographics to teach infographics could be a good way to introduce students to the concept while at the same time providing the infographic instructional content.

Help students get started. To help student get started learning about infographics, teachers could provide assistance in selecting and refining a topic for the infographic. Selecting and refining a topic for an infographic can be challenging for learners. Teachers should also be prepared and ready to help students with the struggles they are likely to encounter visualizing information, thinking about visual layout options and assist students as they start to envision how the data for the infographic may be represented visually. One way that teachers can help students at this early stage would be to organize the class into groups. Using groups during the early stages of the learning process might provide students with additional support and provide opportunities for peer-to-peer

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discussions. As students become more familiar with infographic activities, these group structured assignments could transform into assignments designed for the individual student. The peer support and review structure could be maintained in either approach. If the infographic approach to be utilized involves sketching as in this study, teachers should be prepared to address concerns students may have with sketching or drawing. As the participants of this study suggested, the infographic is more about the information and content conveyed than the quality of the graphics. An effective strategy to minimize the reliance on drawing or sketching to convey semantic contents is to use labels or short written narratives to describe the images and graphics included in the infographic. The use of text-based narratives supports Gallicano et. al. (2014), Purnell (1999), and Toth (2013). Teachers should also consider including time in the infographic lesson, at least early on, to practice basic drawing, sketching or other visualization techniques. Tools and resources would need to be available as part of the lesson to support the learner as they learn how to develop infographics and as they prepare to created their own infographics. These tools and resources could include visual design templates, design options, graphic development tools, resources, and classroom materials as described in the findings of this study. Training videos could also be utilized to supplement instructional activities. Training videos could provide students with additional instruction and provide more detail and access to professional design skills that might not be available in the classroom.

  Alternative approaches to teaching infographics.   Alternative approaches utilizing technology applications for infographic design could also be utilized to develop or supplement the development of infographics. Teachers not interested in using

sketching or drawing for infographic development might also consider using other forms of information visualization such as photographs, graphics, images, clip art, and/or other media. These alternative forms of infographic development, particularly those involving technology might also require additional levels of training and knowledge in order to produce the infographics. Thus additional training might be necessary in order to accomplish similar results in teaching infographics to students. I offer that these alternative forms of infographic development would follow similar infographic teaching process as outlined herein.

Developing infographics. Research question - What do post-secondary teachers perceive to be the skills development, training, and support needs associated with implementation of infographic-based assessments?

As described earlier, as the lesson is being delivered to the learner, the learner begins the process of developing the infographic. The teaching of infographics and the development of infographics are therefore closely related. Table 85 provides an overview of the factors influencing the development of infographics.

Table 85

Factors Influencing the Development of Infographics

Primary Factors
☐ Learning curve, extra work, time involved
☐ Artistic/drawing ability
☐ Learning Style/Learner Types
☐ Visualization Abilities
☐ Design, Layout, Organization, Sequencing
Secondary Factors
☐ Following steps/process/knowing how to develop an infographic
☐ Understanding content enough
☐ Selecting/Coming up with a topic
Tertiary Factors
☐ Visual impairments, disabilities, ADA
☐ Creativity
☐ Using the right data
☐ Overall a challenging activity

Development of infographics like any process with a challenging learning curve may naturally take some time to learn, and may involve extra work from both the teacher and the student. Developing infographics requires a variety of skills and abilities from both a teaching and learning perspective. Some of these skills and abilities may be innate and come more naturally for some and not so intuitive and easily for others. Infographic development may appeal to various learning styles. Table 86 provides an overview of skills and abilities suggested for developing infographics.

Table 86

Skills and Abilities for Developing Infographics

☐ Mastery, understanding of content
☐ Ability to visualize, conceptualize and graphically represent concepts
☐ Creativity
☐ Basic art skills, abilities
☐ Logic, deductive reasoning
☐ Research skills
☐ Open mind
☐ Design skills
☐ Organization skills
☐ Teach to an audience
☐ Technology skills
☐ Not afraid to make mistakes
☐ No unique skill set

It was also pointed out that students with certain learning styles might struggle with the visualization associated with infographics. However, I propose that these infographic development skills can be learned, at least learned to the point where the learning benefits of infographic are realized. As previously described, the relationship between the teaching and developing of infographics can work together to assist learners with developing the skills required in the infographic assignment. Following a process or model during the development of the infographic can also help. The skills necessary to develop infographics are secondary to the underlying knowledge of the subject being considered for the infographic. Of primary importance to developing infographics is understanding and mastery of the content being conveyed in an infographic. Through logic and deductive reasoning infographic developers must grapple with conveying knowledge via a thoughtfully organized visual design and display. It is one thing to have knowledge about a subject, and quite another to be able to visualize, conceptualize, and graphically communicate that knowledge to others using basic art skills, design skills,

and creativity. Infographics should also be based on valid and accurate data further requiring skill from the developer in researching and analyzing data and information sources. Using the right data is paramount for developing infographics that convey valid communication about a particular subject or topic. Infographic assignments that utilize hand drawn or sketched graphical components would rely more on the student's ability to draw or sketch. Infographic assignments that utilized technology tools or applications for development might also require supplementary technology skills training. Infographic developers will require assistance from teachers regardless of approach being utilized.

Assessing with infographics. Research question - How can infographics be utilized in post-secondary educational contexts?

Research question -What do post-secondary teachers perceive to be factors that facilitate and barriers that impede the use of infographics as a form of alternative assessment in post-secondary learning environments?

My thoughts about using infographics parallel those expressed by the participants of the study. Table 87 provides a summary of participant thoughts about assessing learning with infographic.

Table 87

Participant Thoughts about Infographics and Assessment

☐ Good way to evaluate learning/demonstrate understanding
- Good way to see how students can think on feet
- See gaps in learning right away
- Really have to think
- New way of communicating learning
- Easier way to assess critical thinking
- Fun, easy, and effective
☐ Quick, efficient form of assessment
☐ Mitigates plagiarism, cheating,
☐ New and different way to measuring learning
☐ More interesting to grade; something different from every student
☐ Assessment of teaching/inform teaching
☐ Reduce student test anxiety/not like a test anymore
☐ Authentic assessment of learning
- Benefit student more than regular exam
☐ Open teacher minds to other ways of teaching/learning
☐ Balances the grade

Infographics appear to have characteristics that provide a quick and efficient way to assess learning and by providing a means to identify deficiencies and gaps in learning. The development of the infographic requires critical thought and as such, provides the teacher with a way to assess critical thinking in an engaging, creative, and and effective way. Developing infographics requires that students truly think about a subject or topic and provides them with a new way of communicating learning. This new and different way of measuring learning may also be more interesting to grade than other forms of assessment because each student will create something different and unique. As an extra benefit, the original student work required in the infographic may help to mitigate instances of plagiarism and cheating. The infographic also provides a more authentic

assessment of learning benefiting students much more than a traditional examination format. The infographic format may also reduce test anxiety of students because the activity and process of developing an infographic is fundamentally different than a traditional test. In some ways, I think it helps to provide students with another avenue to communicate their learning. Assessment of student infographics can also provide teachers with a window into a teacher's instructional effectiveness. Student infographics could reveal common areas of difficulty among students, which might correlate to teaching approaches. Teachers using infographics might be able to quickly see areas within their instructional strategy that need closer attention, different approaches, and/or other revisions.

Class type/course considerations. Using infographics as an assessment could be influenced by the type of class or course where the infographic assignment is being considered for use. To clarify, it was apparent from the participant responses that certain types of classes might be a better fit for infographics. For example, courses that currently utilize information visualizations such as in the sciences might provide a better environment for introducing infographics than a course designed around a traditionally non-visual context, such as Writing. Further, as described in the finding of this study, there are some academic programs where common courses and common exams are given. These common course formats and/or common assessment formats have the potential to influence the faculty decision to utilize infographics as an alternative assessment.

Assessment challenges. This study supports and expands upon Anderson (1998) regarding the influences associated with changing roles of teachers and students in

response to a non-traditional form of assessment. Changes to the role of the teacher associated with the facilitative and support roles of an alternative assessment like an infographics assignment were revealed and support Sparapani (2000). The challenges for teachers concomitant with implementation of alternative assessments like infographics were identified in this study and support Anderson (1998) and Corcoran et al. (2004). Suggestions by participants about how to approach implementation of alternative assessments like infographics reveal careful and thoughtful consideration regarding the implementation of such assessments echoing cautions by Allen and Flippo (2002).

This study revealed and supports the finding that using alternative assessment approaches requires significant time for planning and design (Ewing, 1998; Sparapani, 2000) and also the actual implementation of the alternative assessment (Ewing, 1998; Purnell, 1999; Sparapani, 2000) and the time needed for feedback (Britton, 2011) and grading (Ewing, 1998). In addition, participants of this study shared Drake's (2001) observations regarding the subjective evaluation associated with altnernative assessments and the differences associated with an alternative form of measuring learning (Britton, 2011; Maclellan, 2004).

Teachers and students may be unfamiliar with the concept of infographics. This unfamiliarity has the potential to influence the use of infographics as a form of alternative assessment. Does the instructor understand infographics enough to grade an infographic? Do students understand the content enough to produce an infographic? Can the instructor interpret the student visuals in the infographics? Table 88 provides a summary of potential challenges associated with using infographics as assessment.

Table 88

Challenges Assessing Infographics

☐ Grading challenges; some type of challenge indicated
☐ How to grade fairly; wide-open on how to assess; subjectivity of grading
☐ Time and effort required, payoff worth investment
☐ Assessing infographics in general; concerns about rubric used
☐ New way of assessing, unfamiliar to students and teachers
☐ No questions of concerns; no overall questions or concerns
☐ Instructor interpreting student visuals
☐ Differences by discipline/class/assignment type
☐ Class type; common courses
☐ Instructor understanding
☐ Grader bias/preferences
☐ Placing too much emphasis
☐ How to grade art
☐ Instructor knowledge of subject
☐ Common assessment practices within discipline (common finals)
☐ Student not really understanding material to begin with

Assessment of infographics should be part of the initial planning and preparation for using infographics as part of an instructional strategy. Ideally, the plan for assessment should be determined before embarking on the infographics path. Assessment of infographics can be a challenging proposition based on what the participants in the study indicated. However, the comments from the participants of this study can be utilized to inform, design, and implement an infographics assessment strategy for use in post-secondary education.

An assessment strategy. When considering implementing infographics as a form of assessment it is suggested that initially, the infographic assignments should be less important to the overall course grade; purposely reducing the infographic emphasis and impact to the student's grade. Expectations can gradually increase over the semester having lower expectations early on as students learn how to develop infographics. Students should become familiar with the concept of infographics prior to using

infographics as an assessment. To help students become more familiar with infographics it is important that teachers understand infographics to the point where they can incorporate infographics into their classes to introduce students to the concept. This will help familiarize students to the concept of an infographic prior to the infographic being used as an actual assessment. Another approach might be to incorporate infographics into the notetaking strategy utilized in the classroom. By exposing students to infographics in different aspects of the instructional process, they will begin to see infographics used more and become engages and familiar with the use of infographics. When students are then asked to develop an infographic to assess their learning, they will have a reference point and more familiarity with the concept of an infographic. If students can begin to see infographics used more in class and also experience the use of infographics in a limited form as in the notetaking example, it might help them become more familiar with using infographics in other course activities and help them be more comfortable with infographics as an assessment activity. Allowing students to provide suggestions to fellow students via peer reviews may also prove beneficial. The peer review provides an informal assessment and helps students refine and improve their infographics. Early on it is recommended that infographics be utilized for formative assessment activities working up to the use of infographics for summative assessments. The specific use of infographics for formative or summative depends on the teacher's familiarity and experience with infographics. Table 89 provides suggestions from the study participants regarding development of an assessment strategy associated with infographics.

Table 89

Participant Suggested Infographics Assessment Strategies

☐   Lower expectations early on, less emphasis on grade
☐   Making sure instructor can develop infographic first
☐   Incorporate as part of note-taking strategy
☐   Peer reviews
☐   Use in multiple classes
☐   Start with formative assessments advancing to summative
☐   Incorporate as part of way students are introduced and subsequently assessed

Grading infographics. Grading of infographics has the potential to be highly subjective. Any decision to use infographics should be informed by a thoughtfully considered grading strategy and supported by awareness by the teacher that the quality of the graphics can potentially influence the grader. It is recommended that a rubric with specific grading criteria be utilized to assess and evaluate an infographics.

Use a rubric. Utilizing a well-designed rubric with clear evaluation criteria can mitigate the inherent subjectivity of infographic grading. A well-designed rubric with clear infographic development objectives and evaluation criteria can assist both the teacher and the student in evaluating the infographic. Rubric criteria can vary significantly and are influenced and dependent upon the specific activity, course, class type, and/or subject being considered for the infographic. In addition, rubric criteria should reflect the instructional objectives and be supported by infographic examples matching the desired evaluation criteria. A starting point for rubric criteria is provided in Table 90. Rubric criteria should be clearly communicated to students in advance of the infographic activity so that students are aware of the expectations and evaluation process being utilized.

Table 90

Participant Suggested Rubric Criteria for Evaluating Infographics

☐ Depth of understanding displayed, key concepts clearly communicated
☐ Level of detail, specific facts
☐ Aesthetics
☐ Logical flow, organization, sequencing
☐ Audience considerations; relevant to audience
☐ Clear goals
☐ Infographic quickly, easily, clearly read, appropriate graphs/data; functional
☐ Balance between creativity/instructional content
☐ Elements of application

Content over graphics. Rubric criteria for grading infographics should reflect the

emphasis upon the content and context components of the infographic and not the

graphical components unless the graphical component is required as part of a specific

activity, class, course, and/subject. Some courses and some assignments in courses may

require criteria specifically associated with the technical and/or graphical aspects of the

infographic.

Certain subjects and disciplines that are teaching information visualization,

graphics, design, and other visual and/or graphical-focused disciplines would naturally be

looking at the quality of the graphics in addition to the content. Teachers can make that

determination but it is important that their preferences and requirements are included in

the rubric criteria and communicated to students.

During the development of the rubric criteria, thoughtful consideration should be

given to the method of infographic creation being utilized. If a sketch-based approach to

infographic design is used, the criteria should reflect an emphasis on the content

contained in the infographic and less emphasis upon the graphics quality. The

expectations for graphics quality should be clearly communicated to students throughout the development of the infographics and reinforced on the rubric criteria.

Interpreting student visualizations. Interpretation of student-developed infographics could lead to grading challenges. It may be possible for students to clearly understand a concept but use a visualization that is not understood by the teacher. To avoid any misinterpretations, rubric criteria should include and emphasize the use of clarifying textual narratives and/or labels to accompany the student infographics.

Infographic examples to clarify expectations. Teachers should consider developing and utilizing example infographic components to graphically represent the rubric expectations. Providing students with graphical examples could help to reinforce the expectations and provide additional clarity for the rubric criteria being utilized for evaluating the infographics.

Practice and Policy Implications

A review and analysis of the research findings of this study reveal several implications for post-secondary educational use of and support for infographics. These practice and policy implications explore how post-secondary educational institutions can support teachers and students using an infographic or similar type of assignment. Additionally, these practice and policy implications address how educational institutions can help teachers and students overcome the challenges, obstacles, and barriers associated with alternative teaching and assessment approaches such as infographics. Figure 50 provides an infographic overview of the practice and policy implications associated with developing a conducive and supportive educational environment for utilizing infographics in a post-secondary educational context.
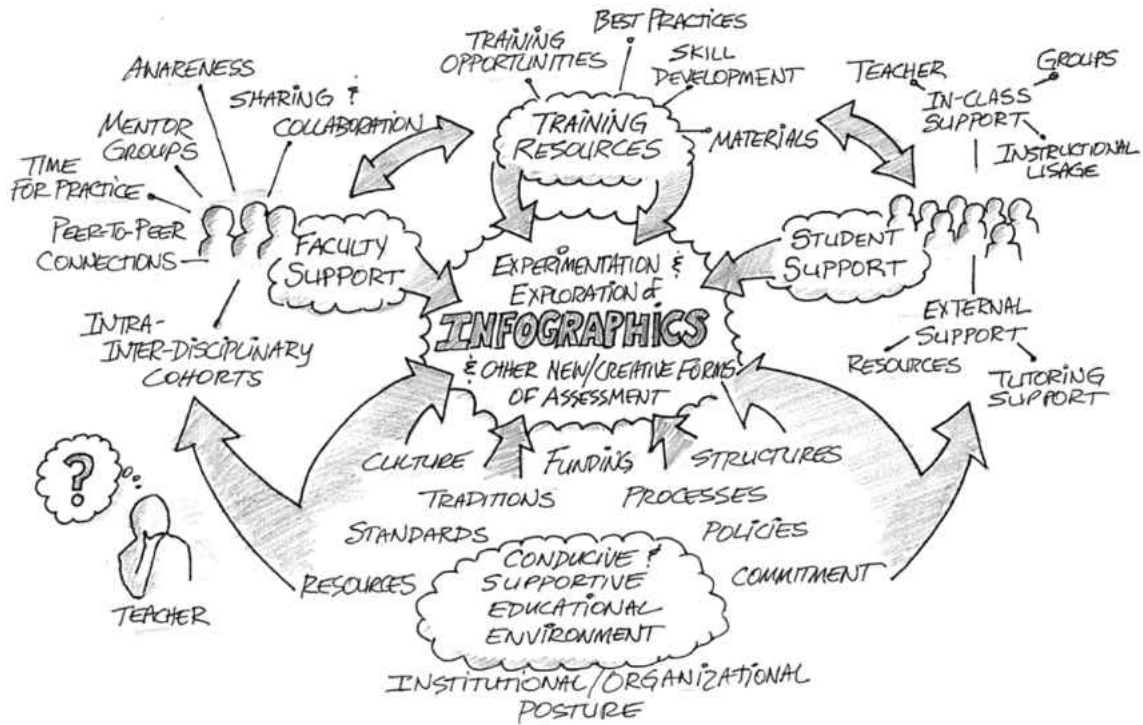
Figure 50. Practice and policy implications. Infographic illustrating the practice and policy implications for supporting infographics in post-secondary educational contexts. Experimentation and exploration of infographics and other new and creative forms of assessment depend upon a conducive and supportive educational environment, faculty support structures, student support structures and access to training and resources.

Teacher support. Teacher-related practice and policy implications focus on the overall educational institution commitment to using and supporting alternative instructional and assessment approaches, the standards and policies necessary to facilitate a supportive educational environment, and efforts to inform teachers about alternative teaching and assessment approaches. Training, resources, and support can also exert influence the use of infographics at the post-secondary education level.

Institution/Organizational commitment. Institutional/organizational commitment is necessary to support the teachers interested in exploring alternative teaching and assessment approaches. Educational institution commitment to the support and encouragement of teachers and students is paramount to the success of an effort exploring

new teaching and assessment approaches. The institution's culture, traditions, structures, processes, and policies all exert influence on the use of an alternative assessment like an infographic. Post-secondary educational institutions should strive to provide their faculty with an environment conducive for experimentation and learning about new, creative, and alternative teaching and assessment techniques creating a culture of exploration into new instructional practices and methods. Standards and policies that allow for flexibility in the provision of instruction and connection to support and resources are essential. The educational institution or academic program units could encourage and support the use of pilot programs to evaluate the application of alternative instructional and/or assessment approaches such as infographics. Further, the educational institution could provide funding, time, and resources to allow teachers to become proficient with these alternative instructional and assessment techniques.

Standards and policies. Post-secondary educational institutions should develop and adopt educational standards that support positive, conducive environments for instructional exploration and use of alternative forms of instruction and assessment like infographics. These standards and policies would provide the foundation for institutional and academic program level supports for teachers interested in evaluating, developing, and incorporating instructional and assessment strategies and encourage exploration into alternative ways of teaching and assessing students. Standards and policies could be developed that encourage experimentation and exploration into new instructional and assessment formats and mitigate barriers and obstacles associated with implementing infographic-type activities. The development of these standards and policies would need

to begin with an evaluation of current instructional and assessment practices within the educational institution's academic divisions and/or programs.

*Awareness of alternative teaching and assessment approaches***.** Supportive educational standards and policies are concomitant with the need for teachers to be aware of alternative teaching and assessment approaches and opportunities. Before consideration can be given to new teaching and assessment approaches such as infographics, teachers need to know about these alternative approaches and methods. An awareness effort could be started within the institution by providing an opportunity for faculty to share teaching and assessment approaches with their peers. Inter- and intra-disciplinary cohorts could be established to provide teachers with a way to connect and network with other teachers working with alternative instruction and assessment strategies. Post-secondary educational uses for alternative instructional and assessment approaches such as infographics could be shared with others in the discipline and in other disciplines across the educational institution exposing teachers to the instructional and assessment applications and learning potential associated with infographics. Further, academic programs within the educational institution could be reviewed to reveal innovative instructional and assessment approaches currently being used. Awareness about teaching and assessment strategies currently in use could help to inform other teachers of possible usage in their own classrooms. Teachers currently using infographics or similar forms of instruction and assessment could share experiences and practices with other teachers. Awareness efforts could also assist teachers in determining the best application of infographics in a particular discipline or course. Additional research to assess student preferences for different learning and assessment activities along with

support for research into the effectiveness of alternative instructional and assessment approaches could also help elevate awareness of different teaching and assessment approaches.

Teacher proficiency, training, and resources. Teachers would need to be provided with training and resources associated with using infographics in post-secondary educational settings. Teacher proficiency, training, and support expectations and standards are necessary to ensure that instructors are proficient and fluent with the alternative instructional/assessment methodology being employed. Educational institutions need to make sure that teachers have access to relevant training opportunities so that they can prepare, plan, design, implement, support, and assess an alternative instructional and/or assessment strategy in their courses. Professional development training programs would need to be developed and offered that provide teachers with the knowledge, skills, and abilities necessary to learn and become proficient with new teaching and assessment techniques such as infographics prior to using the technique in the classroom. Teachers need the opportunity to practice and time to develop skills associated with using infographics in the post-secondary educational context. In addition to the training associated with the infographic format, teachers would need to evaluate their current teaching and assessment approach considering and embracing the changes that might be necessary to utilize infographics in their classes. As part of this training and skill development effort, teachers could assess and evaluate their current teaching styles, methods and assessment practices comparing and contrasting these approaches with alternative approaches such as the infographic activity. Training components addressing teacher attitudes and concerns about alternative teaching and assessment approaches

could be beneficial based on the comments shared by the participants of this study. Exposure to best practices and training on how to grade non-traditional, alternative forms of assessment such as the infographic would be helpful as well as utilization and development of new instructional models to simply the use of alternative instructional and assessment activities. Professional development and training efforts should also include the provision of resources related to using alternative methods of instruction/assessment.

Ongoing support. Ongoing teacher support can be helpful in overcoming the challenges and barriers associated with using infographics in post-secondary education. Support programs for teachers should be available during all phases of the infographics implementation. Support programs that provide assistance to teachers with infographic lesson planning, lesson/activity design, lesson delivery, and lesson assessment could help to mitigate challenges associated with using infographics. In addition, support programs that assist teachers with course selection for infographic use and include course planning and course organization assistant could help teachers in selecting the most appropriate use and plan for implementing the infographic within the context of the overall instructional strategy. Teacher support could be further enhanced by developing teacher training and support cohorts and by cultivating a mentor group that could work with individual faculty and the faculty training and support cohorts as they learn new instructional and assessment approaches. Developing a support group for teachers composed of other teachers provides an opportunity for collaboration, sharing, and collective professional growth. These support groups could be multidisciplinary or unique to a particular discipline and would provide an avenue for sharing the use of

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infographics in various courses/disciplines. Developing a teacher/mentor program to pair mentors with teachers as a supportive and assistive guide for implementing alternative teaching and assessment approaches such as infographics could be beneficial and provide a way to connect faculty with instructional and assessment guidelines, models, and best practices. Development of faculty cohorts, similar to that utilized in this study could provide a multi-disciplinary group approach to learn about and incorporate infographics or other alternative instructional and assessment approaches.

Student support. Students, like teachers, should also have access to a support network and resources to provide assistance in educational environments that employ alternative teaching and assessment practices like infographics. Silverman and Piedmont (2016) relate that training and support for students developing content to convey information visually is lacking.

Teachers using infographics in coursework should strive to be proficient and confident developing infographics as they will be sought out and relied upon by students as a primary source of support and assistance during the infographic development process. The support for students should be offered both inside and outside the classroom. In-class student support activities might include exposing students to the use of infographics in multiple classes and across the post-secondary educational experience. Teachers could also model and use infographics as part of their overall instructional strategy using infographics in class presentations and in communicating information to students. These efforts would help to familiarize students with the infographic concept and provide examples that could be used in developing their own infographics. Teachers could also provide students with opportunities to utilize infographics to support other

learning activities such as with a notetaking strategy. Using this approach, students could get practice utilizing infographics to take notes as they learn more about the concept. Use of small groups during class activities provides another layer of student support.

Students will also need a place to go where they can receive help and have access to resources that will help them complete the infographic assignments external to the classroom. This support should begin with the teacher and extend beyond the classroom to include peer groups, additional training opportunities, and access to support mentors and tutoring. Students should also have access to additional infographic-related training and support external to the class environment including infographic training videos, infographic examples, and other web-based applications and resources that support infographic development.

Limitations

Although this study has answered the research questions posed, the qualitative nature of the study prohibits a generalization of results. The small group of teachers participating in the study was representative of the academic divisions of the college where the study was conducted but a larger group of faculty representing additional subject and discipline areas could yield further insight and information. This research focused on the lived experiences of professional teachers in a two-year, post-secondary educational environment, which limited the educational perspectives to a specific post-secondary educational context. The focus of this study involved sketch-based infographics, which limited insight from participants to a particular form of infographic design. Although this limitation was intended, the study produced results that may be applicable to other methods of infographic development approaches. Finally, the relatively short infographics training session and limited time for participant exposure to

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the concept of infographics may have influenced participant responses. Additional training, exposure, and experience with sketch-based infographics might provide more suggestions and thoughts related to the post-secondary educational applicaton of infographics.

Future Research

This study has explored the use of infographics as an alternative assessment in a specific, post-secondary educational context. The information resultant from this study can be utilized to inform decisions about the use of infographics, guide the teaching and development of infographics, and inform assessment practices related to infographics. To expand and further this research, additional faculty insights and perspectives from across multiple post-secondary disciplines and subject areas should be explored along with research into the effectiveness of infographics compared to traditional instructional/assessment methods. Student perspectives about the use of infographics and other alternative instruction and assessment methods could also provide valuable pedagogical information for post-secondary educational contexts. Expansion of knowledge into both teacher and student perspectives involving infographics and other non-traditional, alternative forms of instruction and assessment could be useful in informing the use of alternative instructional/assessment strategies in post-secondary education and influence post-secondary teaching practices. This study has revealed specific barriers, challenges, and factors that influence the use and development of infographics in post-secondary education. Additional study into the factors that limit, restrict, and challenge the use of non-traditional instructional and assessment practices in post-secondary education is warranted. This study also revealed suggestions for supporting both teachers and students throughout the infographic development process.

Further research exploring support structures, practices, and policies involving use of alternative forms of instruction and assessment could provide educators and education policy makers with examples of best practices. Teacher and student perspectives related to support needs associated with infographics and/or other alternative forms of instruction/assessment could help contribute to a greater understanding about the instructional and support environments necessary for effective pedagogical implementation. The participants of this study taught in both face-to-face and online instructional environments and the perspective they shared can be applied to both instructional modalities. Additional research into the use of infographics and/or other alternative forms of instruction/assessment specifically in an online learning space could provide new perspectives and insight regarding the differences between the online and face-to-face classroom application of infographics. This study utilized a sketch-based approach for infographic design. Further research involving the use of technology applications for infographic design and development may provide more information about using infographics in post-secondary educational contexts and provide additional insight into which form is more effective. Finally, additional research involving the use and support of alternative approaches to instruction and assessment in post-secondary education along with an exploration of information visualization learning and assessment strategies may advance and expand the use of such approaches in post-secondary education.

Conclusion

For as long as I can remember, I have utilized visualization of information as a way to help me to understand concepts and communicate my understanding about those

concepts to others. I wanted to share this skill with others because I believed that post-secondary teachers and students could benefit from being exposed to infographics. I also realized that I had an innate ability for visualizing information and I was curious to see if this is something that can be taught to post-secondary teachers. As part of this research I developed a model for infographic design that could be used to develop this skill. I also knew that for the most part my participants would be unfamiliar with the concept of using infographics as a form of alternative assessment. I was curious to see what other teachers would think about using infographics. My experience with using infographics has been very positive and the rationale for this research was to explore application of this form of learning and assessment in the post-secondary educational environment.

After completing this study I feel more confident than ever that infographics have a place in not only post-secondary education but in other educational contexts. I have a better idea now about some of the challenges and factors that may impact and influence the use of infographics in post-secondary education. Having used sketching and infographics in my own life, I now can see how this form of expression has influenced other post-secondary education professionals. The educators who volunteered for this study were open to learning something new and to see how they responded to the training was enlightening. The experiences shared and the insights learned paint a picture of a post-secondary environment that has considerable but manageable challenges for application of alternative forms of assessment. I suspected that there would be distinct differences between the subject/discipline areas. What surprised me was the commonality among the different disciplines. Although certain disciplines appear to be better suited for infographics, I think that infographics could be utilized in most any post-secondary

educational application provided attention and thoughtful consideration is given to the most appropriate and applicable use of infographics. The successful use of infographics in post-secondary educational classrooms depends upon a supportive and facilitative educational environment, a skillful and adaptive teacher, careful instructional planning and preparation, effective instructional design and delivery, and application of appropriate assessment strategies.

The insights shared by the participants reflected their perspectives and points of view yielding suggestions for applications across the broad spectrum of teaching and learning activities. One of the most interesting and fascinating aspects of this study involved exposing teachers to a new form of learning and assessment. It was exciting to see the teachers embrace infographics. Once the teachers were immersed into the infographics development experience and they began to familiarize themselves with the content, they were able to take their experience developing infographics and combine that experience with their teaching knowledge to share how infographics might be applied to teaching post-secondary students. The shared experiences have resulted in a set of suggestions and tips for post-secondary educational application of infographics. Post-secondary teachers and others interested in learning more about how infographics might be utilized in their classrooms can utilize the information contained in this study as a resource and model for application. Although this research focused on infographics, I believe that some of the insights and suggestions could also apply to other forms of alternative instructional and assessment techniques.

Some participants came to this study with more infographics or information visualization experience than others. Some had ideas about how infographics might work

in their classes, some did not, and some were not familiar with infographics at all. Regardless of how the teachers began the study, I think all of the teachers emerged from the study with a better understanding of, and an enthusiasm about the possibilities of this emerging form of teaching, learning, and assessment. It is my hope that others reading about the experiences of these eight teachers will learn more about how infographics might be utilized in post-secondary educational contexts and continue to the exploration into new, innovative, and alternative forms of instruction and assessment shaping the emerging post-secondary educational landscape.

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Zuk, R. (2011). Invasion of the infographics: Visual makeovers inspire digital insights and innovation. *Public Relations Tactics*, *18*(10), 7.

Appendix A
Conceptual Framework
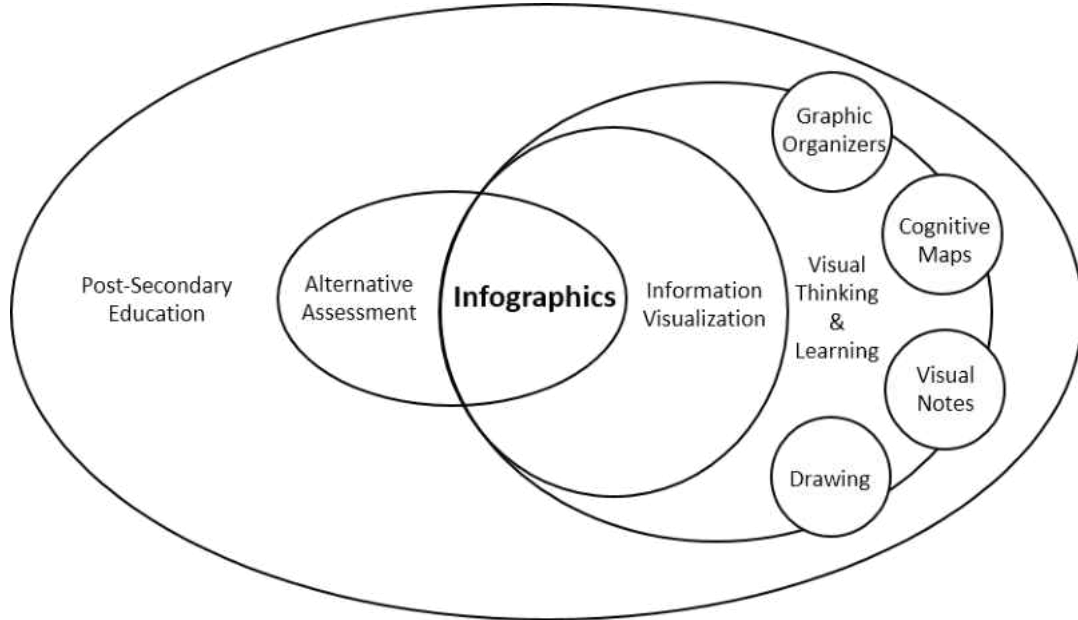
Conceptual Framework. Infographics are a form of alternative assessment based on the concepts of information visualization; Information visualization is influenced by visual thinking and learning concepts. The use of infographics is studied in the post-secondary educational context.

Appendix B
SKETCH Model - Infographics Training Program

SKETCH

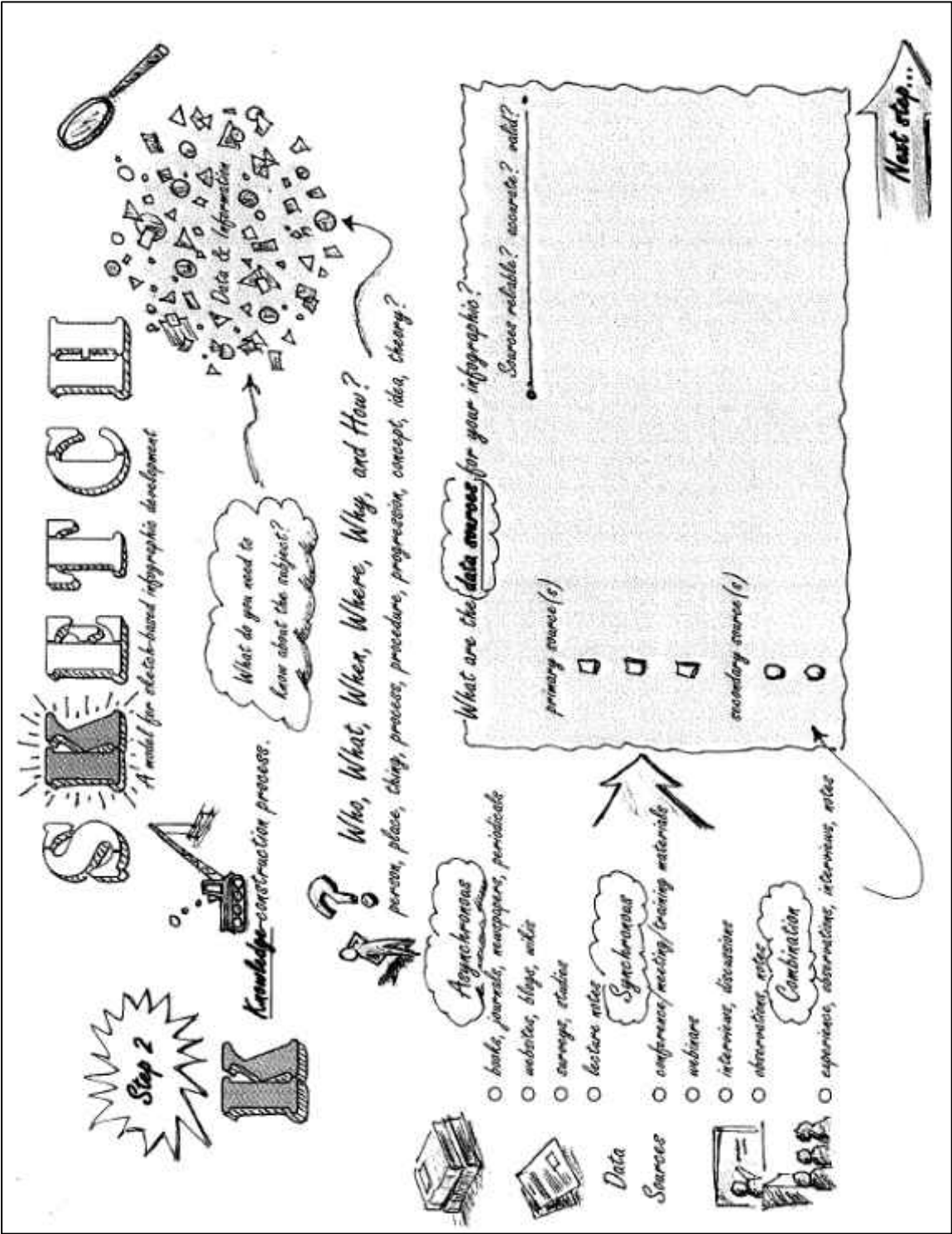A model for sketch-based infographic development

Step 1

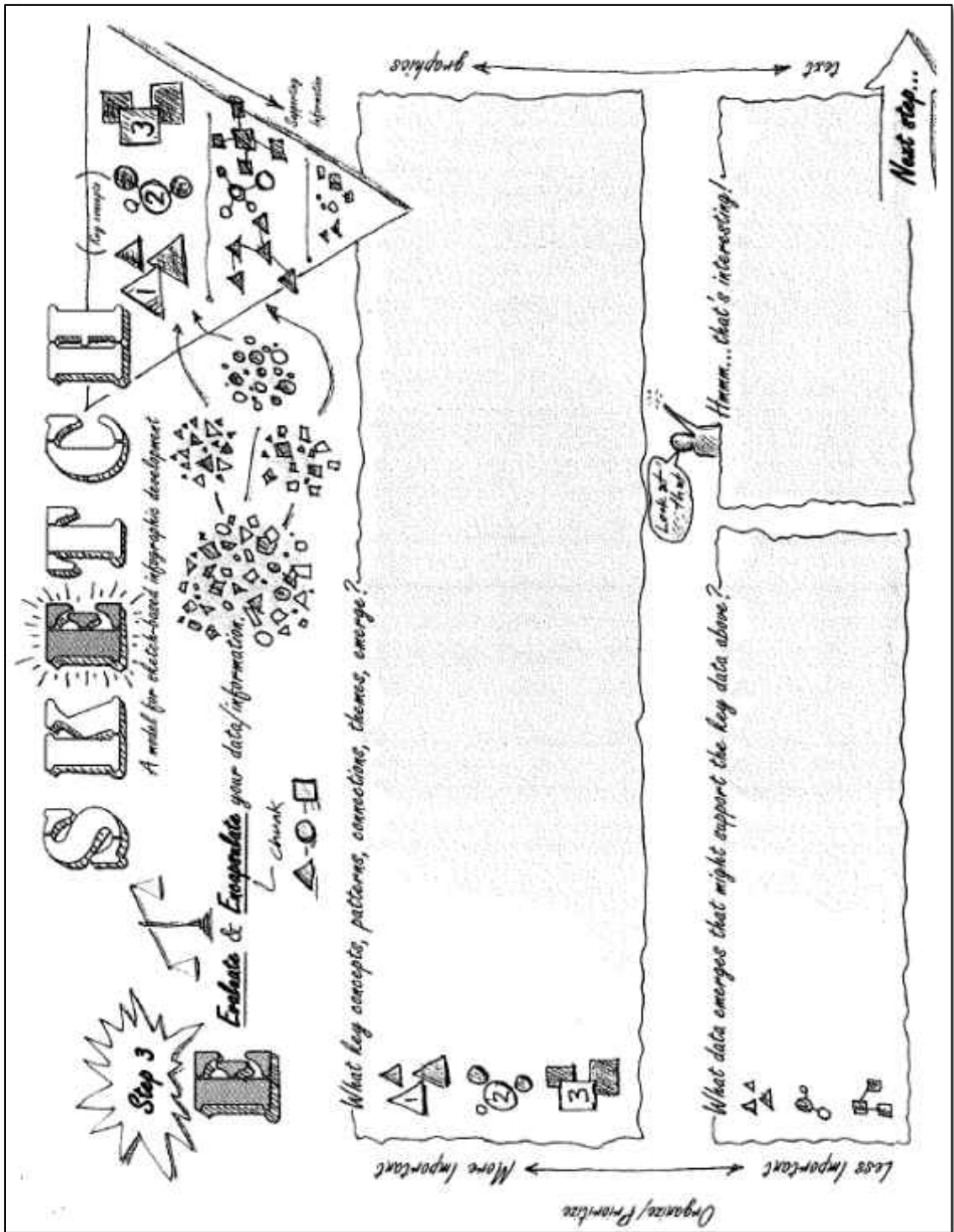Select a **subject** for your infographic.

IDEAS

Subject Ideas

- overview or summary: course, unit, chapter, concept
- lecture guide, lesson plan, lesson outline
- processes, procedures, timelines
- exploration: issues, topics, biographies, timelines
- cause/effect, pro/cons, compare/contrast, for/against
- syllabi: expectations, evaluations, projects
- hierarchies, organization, relationships, connections
- conference sessions, webinars, meetings, training session
- research paper, book report, literature review
- resumé, announcement for event/activity, club

Purpose of your infographic?

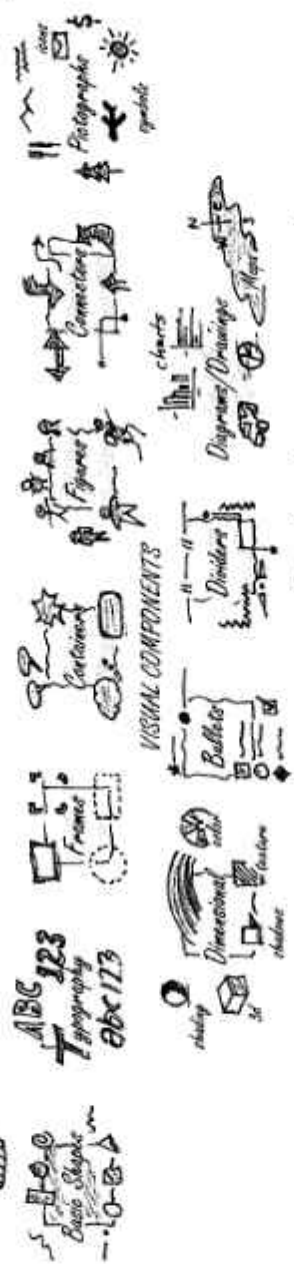Describe your **audience**?

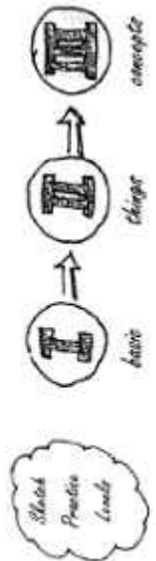Next step...

497

SKETCH

A model for sketch-based infographic development

Step 3

Evaluate & Encapsulate your data/information.

Chunk

(key example)

Supporting information

What key concepts, patterns, connections, themes, emerge?

What data emerges that might support the key data above?

graphics

text

More Important

Less Important

Organize/Prioritize

Next step...

Look at that!

Hmm... that's interesting!

SKETCH

A model for sketch-based infographic development

Step 6

Harmonize & Hone your infographic design.

- Refine initial design by adding contextual design elements (frames, dividers, connectors) and other visual components
- Add labels, captions, summaries, descriptions, headings to clarify content
- Add dimensional components (shading, shadows, color)
- Include a brief narrative to be included on/with the infographic (describing purpose and summarizing infographic)

Write brief narrative...
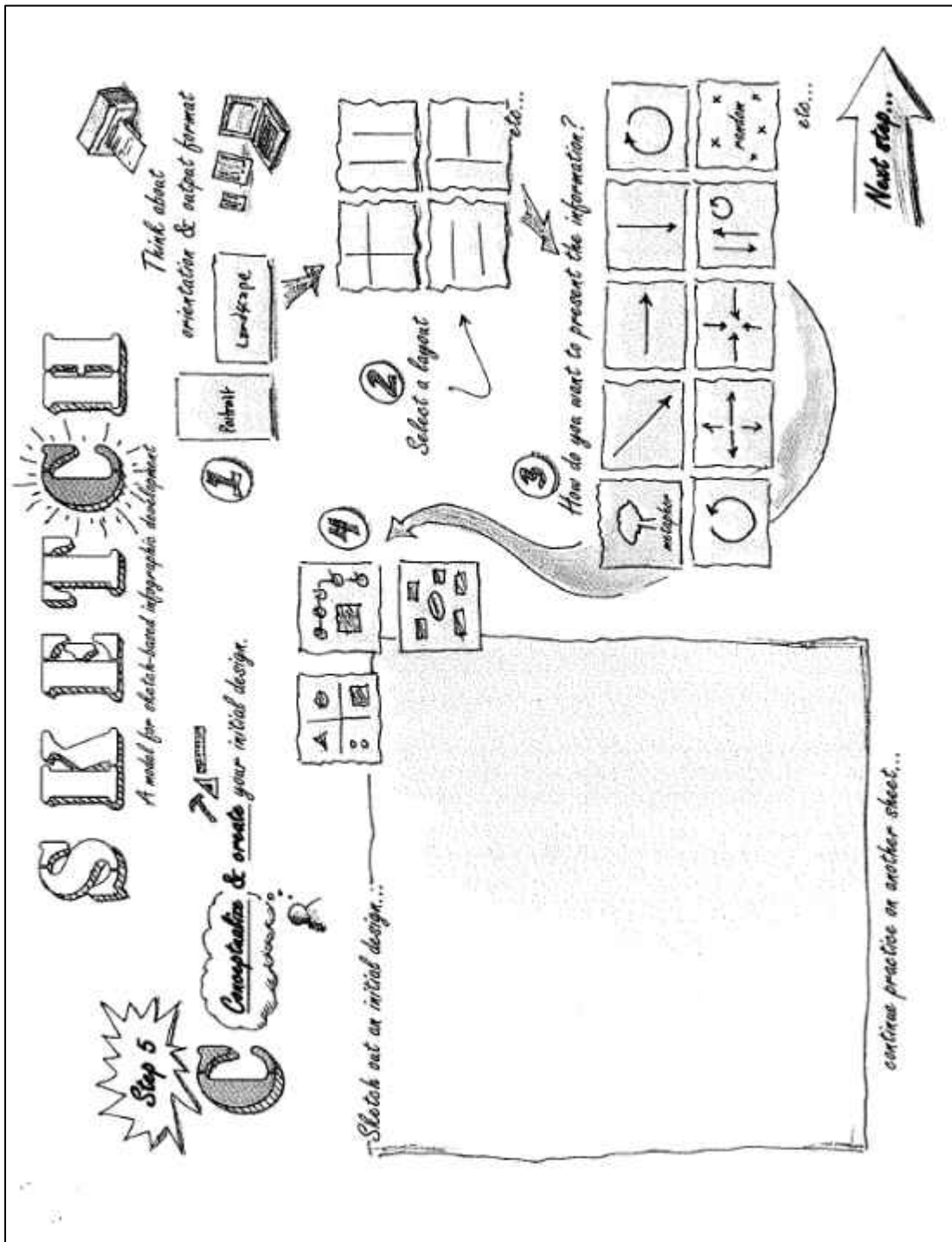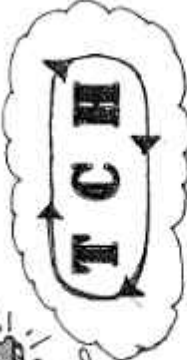
Refine the design and add finishing touches...

TCH

Complete final infographic on separate sheet...

501

Appendix C
Interview Protocol

Interview Protocol

1. Please describe your educational experience, your teaching discipline, and your professional background.

2. Please describe your experience with information visualization and/or infographics prior to participation in the infographics training program. Do you currently use infographics-based activities in your classes? If so, please explain.

3. What were your initial perceptions and thoughts about participating in this study and about the infographics training?

4. Now that you have had a chance to experience the training program and the development of an infographic, please share your thoughts and perceptions about the experience.

5. What did you learn from the infographic training and development experience? Please share your insights, thoughts, realizations, perceptions.

6. Has this training experience influenced your thoughts about using infographics in an educational context? If so, please explain.

7. Please describe any educational benefits or advantages you perceive as being associated with developing infographics in an educational context. What about any disadvantages or negative aspects?

8. What are your thoughts about uses for infographics in your teaching discipline? What about post-secondary education in general? How might they be utilized?

9. Please describe what you experienced as you went through the process of developing your infographic.

10. Did the development of your infographic improve your understanding of the topic/subject you selected? If so, please explain how you think it improved your understanding.

11. What do you think are some specific learning outcomes that are produced by engaging in the process of developing an infographic? Please identify and explain.

12. What are your thoughts on how the infographic you developed might be utilized to assess your understanding of your selected topic/subject? How would you assess an infographic?

13. Think about the learning and assessment activities that you currently utilize in your classes. How does an infographic activity compare? Are there similarities? Differences? What are your thoughts about using an infographic-based activity as an alternative to any of these currently used learning and assessment activities?

14. Do you think using an infographic as an assignment would help teachers assess the learning of their students? If so, how? Please elaborate and explain.

15. What do you think about using infographics as a form of alternative assessment in your teaching discipline? What about post-secondary education in general? Do you have any questions or concerns about using infographics as an assessment?

Do you perceive any benefits or positive aspects of using infographics for assessment? What about any negatives?

16. What factors do you see impacting or influencing the use of infographics as an alternative assessment in post-secondary education? Please explain.

17. Please reflect on and describe the thought processes you experienced and utilized to design and develop your infographic. What are your thoughts about how this process/experience might impact student learning if they were asked to develop their own infographic?

18. Describe any aspects of the infographic development process that you found challenging and/or difficult. Were there aspects of the training your found easier or more intuitive? Please explain.

19. Similarly, describe any challenges and/or difficulties you perceive regarding the use of infographics related to your students and/or your teaching discipline. What are your thoughts about how these challenges and/or difficulties might be addressed?

20. Now that you have had a chance to develop your own infographic and experience a training program designed to assist in the development of an infographic, what barriers and/or challenges do you perceive for students in learning to develop their own infographics? What barriers and/or challenges do you perceive for teachers that might consider using infographics in their classes? What are your thoughts about how these barriers and/or challenges might be addressed?

21. Based on your training experience and the development of your own infographic, what do you perceive as the characteristics, skills and abilities necessary to develop an effective and meaningful infographic? What about the teaching skills and abilities necessary to help someone learning to develop an infographic?

22. What are your thoughts about the training needs for someone learning to develop an infographic? What do you perceive as the help and support that might be necessary to help someone learn about the infographic development process?

23. Please share your thoughts about the infographic development model used in this training. To what extent did this infographic development training program prepare you to develop an infographic? Please explain.

24. What do you think about the training program model's use in post-secondary education as a teaching tool to help students develop an infographic?

25. The training model you experienced utilized a sketch-based approach to infographic design. What do you think about this approach? What do you think about the approach using drawing first instead of applying technology tools to develop the infographic? Please explain.

26. Please describe any aspects of the training program that you thought worked well. Please also describe any aspects of the training program that did not work so well or could have been improved. Do you have an instructional recommendations or suggestions? If so, please explain. Were there elements of the program that you needed to spend more time or less time? If so, please explain.

27. Please take a moment to reflect on your training experience and think about how you might teach students how to develop an infographic. Please describe how you might approach the teaching of infographics and your vision of an ideal training environment and process for developing infographics. In your opinion, what would help facilitate the teaching and utilization of infographics in post-secondary education?

28. Would you recommend this training program for other post-secondary teachers? If so, why? What would you like other post-secondary teachers to know about infographics? What would you share with other post-secondary teachers about your experience developing infographics?

29. Are you planning on incorporating infographics into your classes? If so, please describe how you might use infographics in your classroom.

30. Overall, what are your thoughts about the training experience? Has participating in this experience influenced you? If so, how has it influenced you? What are you taking away from this experience?

Appendix D
Initial Coding

Initial Coding

The following codes are included to provide additional insight into the concepts and ideas shared by participants of this study. This list of codes was condensed and distilled into the five concepts associated with this research: Using Infographics, Teaching Infographics, Developing Infographics, Assessing with Infographics, Infographics and Learning.

Alternative Assessment (infographics as)
Artistic ability/Drawing ability
Assessment
Assessment (questions or concerns about using infographics as assessment)
Assessment challenges
Assessment of learning (thoughts about how infographics capture and represent learning)
Assessment suggestions (designing assessments, assessment value)
Benefits of infographics
Challenges (general)
Challenges for teachers
Challenges perceived for students
Challenges/Difficulties developing an infographic
Change (resistance to)
Characteristics of Infographic-based assignments (thoughts about infographics in general)
Classroom activities
Compensates for lack of reading skills
Creativity
Current use of infographics
Design elements/design considerations
Developing an infographic assignment/assessment
Development time
Different way to learn; something different to see
Difficult work
Disadvantages, negative aspects, drawbacks
Discipline (using different disciplines in training)
Discipline/Program differences and considerations
Drawing instruction/drawing class
Drawing vs. Technology to develop infographics
Drawing/sketching ability influences to infographics
Enhance classroom experience
Evaluating and assessing infographics
Examples
Examples (use of and benefit for)
Extra work
Extra work/harder work
Factors influencing the use/development of infographics
Factors influencing use of infographics
Faculty

Generational Differences
Getting faculty buy-in
Getting information right
Groups (use of in training)
Incorporating infographics into a class (thoughts about using in higher ed
Infographic development model (thoughts/perceptions about)
Infographic development model in post-secondary education
Infographic development requirements
Infographic Training Program (aspects that could be improved)
Infographic Training Program (aspects that worked well)
Information visualization experience (prior experience with infographics)
Instructor knowledge of infographics
Interest level (building interest in courses/disciplines)
Knowledge about subject/topic
Knowledge Base (understanding of topic)
Learning (in general)
Learning associated with infographics assignments
Learning curve for developing infographics (using infographics in class)
Learning curve for students and faculty
Learning Styles
Lecture format of classes
Lectures (use in)
Mapping
More intuitive aspects of infographics (perceptions about process that may have been easier)
Motivation for participating in study
Motivation to incorporate infographics
Narrative paragraph (to support infographic/drawing elements)
Need (for infographics type assignments or alternative assessment needs)
Non-traditional students
Notetaking (using infographics for)
Online classrooms and infographics
Overcoming challenges, obstacles, barriers, resistance
Participant Background/Demographic
Peer review
Perceptions (initial) about study and training
Perceptions and thoughts about training experience (after)
Planning and organization (pre-planning)
Post-secondary usage of infographics (thoughts about)
Practice time
Presenting information (infographics as a way of presenting)
Previous Use of Infographics
Process (infographic development as a process)
Program/Discipline considerations
Progression of use
Quizzes (use in)

Requirements (necessary to develop an infographic)
Restrictions to teaching (problems with teaching and learning in schools)
Rubrics and guidelines
Sequencing/Process related
Similar types of activities currently used in class
Sketching infographics (thoughts)
Skill set for developing infographics (characteristics, skills, abilities)
Skill set for teaching infographics
Students with disabilities
Supplemental activity
Syllabus (using infographics for a syllabus)
Teacher developing as model
Teacher notes for students
Teacher thoughts about using infographics in their classes
Teacher training (importance of)
Teacher understanding infographics more
Teacher understanding of subject
Teaching (general)
Teaching infographics
Teaching resources, help and support for infographic development
Teaching Suggestions (things that might do to teach)
Technology (general; use to develop infographics)
Technology considerations by discipline
Technology Considerations with infographic development
Textbook (better use of)
Thoughts about developing infographics (general thoughts)
Thoughts about infographics (general thoughts from participants about infographics, why they might recommend to others)
Time
Time in class
Time required to assess
Time required to learn/incorporate
Timing/Pacing of infographic training program
Traditional ways versus new ways of teaching
Training environment considerations
Training on data visualization
Training Related
Training, resources and support for developing infographics
Use across multiple classes (more exposure to infographics)
Use in different disciplines (thoughts about)
Uses for infographics in class
Various types of assignments
Visualization abilities
Visualizing concepts