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Identifying Student Approaches to Learning: Undergraduate Student Perceptions of Teaching and Learning at the University of Windsor

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By

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ABSTRACT

This research study investigated the approaches to learning of undergraduate students to better understand their perceptions of their learning environment. Participants were sixty (*N*=60) undergraduate science students at the University of Windsor. Using an online survey comprised of the R-SPQ-2F (Biggs, Kember, & Leung, 2001), open-answer questions, and demographics, quantitative and qualitative data were collected and analysed. It was found that deep approach scores were higher and surface approach scores lower among fourth-year students compared to first-year students. Participants identified time, course design, study habits, personal interest, and effort as factors that influenced their learning. Student recommendations for teaching and learning improvement included renewed commitment to faculty development and reflective teaching practices. Participants' responses illustrate the importance of student feedback in understanding the relationship between teaching and learning. The results of this research have implications on teaching and learning at the University of Windsor, and prompt further research throughout Ontario.

DEDICATION

This thesis is dedicated to my parents Maria and Roger Sabourin for always believing in me and encouraging me to pursue every opportunity available. Thank you both for all you have done for me throughout the years. This thesis is also dedicated to my brother Mike Sabourin, who has supported me and been the best friend I could have asked for.

I also dedicate this to my wife, Lauren Sabourin, who has been my main source of support throughout my B.Ed., M.Ed., and soon-to-be Ph.D. studies. She earned this thesis almost as much as I have by keeping me on task and motivated to see this project through to the very end. I love you.

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LIST OF ABBREVIATIONS

DA	Deep approach
DM	Deep motive
DS	Deep strategy
OBE	Outcomes Based Education
R-SPQ-2F	The Revised Two-Factor Study Process Questionnaire
REB	Research ethics board
SA	Surface approach
SAL	Student approach to learning
SM	Surface motive
SoTL	Scholarship of teaching and learning
SS	Surface strategy
UWindsor	University of Windsor

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CHAPTER 1: INTRODUCTION

Student Learning and Higher Education

The undergraduate learning experience has changed significantly since the beginning of the 21st century (Altbach, Reisberg, & Rumbley, 2009; Thomson, 2015). There has been a shift at many postsecondary institutions to move away from traditional modes of teaching and assessment, such as lecture-laden presentations and multiple-choice testing, to strive for teaching methods that encourage the student to take an active role in their learning.

It is also an emerging reality that universities in Ontario are facing budget cutbacks while still needing to be fiscally responsible and procedurally accountable to multiple stakeholders such as funding agencies and Ontario taxpayers (Lodge & Bonsanquet, 2014). A report by the Higher Education Quality Council of Ontario (HECQO) (2012) on the productivity of the Ontario postsecondary system describes that "the key to future success is to increase productivity in ways that do not compromise quality," however, their solution is to measure productivity by enrollment and graduation rates, as well as research output compared to research funding (p. 9). An evaluation system of postsecondary education which relies solely on economic markers exclusively is problematic if higher education is to be seen for what it is – a transformational experience – rather than just a transactional experience between students and institutions. Enrollment and retention rates are effective measurements, however, if paired with data that qualitatively describes the postsecondary student experience.

Students are the direct recipients of the teaching efforts of postsecondary institutions. As such, it is important that undergraduate students receive what they are paying for: an opportunity to learn. It is clear that universities and colleges are in a position to effectively teach students, but is education actually about *teaching*? Are students attending postsecondary institutions *to be taught*, or *to learn*? The two are often set in binary opposition to one another, but they can actually work in tandem. Much the same as St. James suggests that "faith, if it has no works, is dead" (James 2:17, NASB), teaching is the set of collective efforts that promote learning. Barr and Tagg (1995) suggest that learning is what universities should be striving for. While there is no obvious answer to address this critical differentiation, it is a situation that is playing out in Canadian institutions, especially in Ontario. My research acknowledges Tagg's (2003) suggestion: to ask "students what *they* think has been important in their own education, [to examine] options that we were unaware even existed" and reinforce learning (p. 33). Using students' ideas to inform learning experiences is student-centred teaching, and promotes deep learning (Biggs & Tang, 2007; Tagg 2003).

Student Approaches to Learning

The quest to explore how students learn is not a new one. Researchers and teachers alike have been investigating student learning through formal research, anecdotal classroom trials, and communities of practice. Each undergraduate student (and indeed every student) engages in actions and makes decisions that influence their learning; not all students are aware of the effects their actions have on their learning. These decisions, "what the student does" comprise a *student approach to learning* (SAL; plural SALs) (Biggs & Tang, 2011, p. 20). Student approaches to learning are identified

dispositions which students take towards learning in a particular experience, and which are a result of their perceptions of their learning environment, as they understand it through actively engaging in it.

A substantial group of educational psychologists and educators have devoted research careers to understanding how students learn (e.g., Biggs & Tang, 2011; Entwistle, 1984; Entwistle & Tait, 1990; Marton & Säljö, 1976a, 1976b; Trigwell, 1995). Research into student learning began as much psychological research begins: in controlled experimental scenarios designed to create an atmosphere that can be replicated, in order to predict an outcome. Beginning with aptitude tests, this original approach to student learning research is still being practiced. It became clear to some, however, that teaching and learning did not occur in a vacuum. Rather, the context of the learning environment, and all the variability within it, directly affected student learning. Instead of trying to find the "one grand theory of learning," educational psychologists flipped their approach to student learning research by observing students in their natural learning environment, and exploring the qualitative aspects of their experiences (Biggs, 1999, p. 59).

Marton and Säljö's (1976a) study was the first to take this approach and provide a potential way of classifying student learning. Their work describes students who used either surface-level or deep-level processing during a reading comprehension exercise. These two categories, deep and surface, have since become the basis of classifying student approaches to learning. Educational psychologist John Biggs has been investigating student approaches to learning in Australia, Canada, and Hong Kong since the late 1970's through a constructivist reading. His influence on teaching and learning

development has spread throughout the world, and forms some of the foundations for student learning research: the 3P Model of Teaching and Learning, intended learning outcomes, constructive alignment, the SOLO taxonomy, and student approaches to learning (Biggs 1979, 1987a, 1996a, 1996b; Biggs & Collins, 1989; Biggs, Kember, & Leung, 2001). These concepts have been incorporated in various forms throughout all levels of education, and are especially present in postsecondary education.

The Current Study

In this study, I examine undergraduate student approaches to learning at the University of Windsor, a medium-sized urban university in Ontario, Canada. My research study examined the approaches students from the Faculty of Science are taking to their undergraduate learning as a way to understand their learning experiences. I identify the dominant approaches to learning of undergraduate students as self-identified through a well-tested instrument, the *Revised Two-Factor Study Process Questionnaire* (R-SPQ-2F) created by Biggs, Kember, and Leung (2001). I also illustrate contextual factors and highlight students' conceptions of learning in order to more fully understand their experiences.

Research Questions

The purpose of this study is to identify the approaches to learning of undergraduate students studying in the Faculty of Science at the University of Windsor. More specifically, my research provided a measure of students' perceptions of their learning environment. My research was guided by a fundamental research question: *which student approaches to learning are undergraduate science students at the University of Windsor identifying as their dominant approach?* In addition to identifying

the approaches to learning of undergraduate students, I addressed four additional questions about postsecondary teaching and learning: (a) *how do students define learning?;* (b) *do participants' dominant approaches to learning align with their definitions of learning?;* (c) *what factors are contributing to the dominant approaches identified?;* (d) *from the student perspective, how might the identification of student approaches to learning be useful to inform university teaching, learning, and educational development?*

Through the collection of quantitative and qualitative data from an online survey administered to a cross-section of undergraduate science students at the University of Windsor, these questions were addressed to better understand these students' postsecondary learning experiences.

Hypothesis

I anticipated finding that the dominant approach to learning in the Faculty of Science is a surface approach, held predominantly by those in fourth-year. In keeping with trends found in the literature (Biggs, 1987; Gow, Kember & Cooper, 1994; Watkins & Hattie, 1981), deep scores would be lower and surface scores would be higher for fourth-year students compared to first-year students. As for students' conceptions of learning, I suspected the responses would be wide and varied, but that most would describe learning as a passive transmission of knowledge. In this respect, I foresaw alignment between dominant approach scores and conceptions of learning only in those cases where the surface approach score was dominant. The factors influencing student learning are unknown, and I believed would be unique, highlighting the collective narrative each student added to by their participation. Finally, I anticipated that students

would have many ideas for the use of this research, most likely to justify their opinions that the university could do a better job providing their undergraduate education experience.

Theoretical Framework

In order to ground my research, I will focus on two interconnected theoretical frameworks to provide a rich foundation of reason and help guide the investigation and analysis of the project. The first framework is constructivist theory which will define the parameters of student learning as they relate to my study. The second framework is Biggs' *3P Model of Teaching and Learning*, which reconciles the various aspects of the educational experience: educational development and design, intended outcomes of learning, teaching approaches, and student approaches to learning.

Constructivist theory. My research draws heavily from constructivist ideas, and therefore it is critical that I provide an overview of the main components of the framework used. Thayer-Bacon (2005) described philosophical constructivism simply yet eloquently as "the idea that knowledge is something human beings create in dialogical relationship with others … and can be traced back to Socrates in ancient Greece" (p. 48). Constructivist thinkers have built on this basic premise in relation to education, the most notable being Jean Piaget (1977), who outlined that learning happens through active engagement where learners construct meaning from their experiences, rather than a passive reception of knowledge. Learners must make meaning from what they experience, either assimilating the experience into pre-constructed schemas, or accommodating for the experience by constructing new schemas and engaging in higher levels of thinking (Woolfork, Winne, & Perry, 2015). As a theoretical lens then,

constructivism has implications on the design of educational experiences, what students will be expected to do and know, how they will be assessed, and their personal beliefs about education.

There are those, however, who are critical of constructivism being adopted as the dominant paradigm in education. Mayer (2004) cautioned against what he called the "*constructivist teaching fallacy* … [of equating] active learning with active teaching" (p. 15). Matthews (2003) claimed that constructivism promotes an unattainable relationship between teaching style and student ability, and "is not an empirically defensible practice" (p. 58). In fact, a study by Baetens, Dochy, and Struyven (2008) concluded that constructivist teaching methods did not result in a deeper approach to learning in the 138 undergraduate office management students who participated. The preceding claims against constructivism are legitimate, depending on the scope of research conducted. It is important to understand that for each researcher who makes claims against constructivism's governance (Baetens et al., 2008; Matthews, 2003; Mayer, 2004), there are others who champion the very opposite in defense of constructivism (Biggs & Tang, 2011; Potter, 2013; Wiese & Newton, 2015). As seen in the numerous research studies I present in the next chapter, context is critical when understanding the implications of a constructivist approach to teaching.

If the approaches and strategies students take to their undergraduate education truly do affect learning, it seems most logical that constructivism be used as the lens for understanding student approaches to learning. If constructivism is to be adopted, it is important for the voice of the meaning-makers – the students – to be audible to those who teach, develop, and administer postsecondary education. My research allowed this to

occur, insofar as to understand not only the experiences of students themselves, but also the larger context of their learning environment.

The constructivist notion of students as active participants in their postsecondary education affects the teaching culture of Canadian post-secondary institutions. In a large multi-institutional study, Kustra et al. (2014) found that undergraduate and graduate student responses to a developed teaching cultures indicator questionnaire identified that students "valued a quality teaching culture more highly than they perceived their institution did" (p. 66). Regardless of how accurate the students' perceptions, the perceptions were themselves a by-product constructed by active engagement as a student of the institution. The voice of the students may be correct, or misaligned, but without investigating them, an institution defines priorities by omitting the influence of a valuable source of feedback.

Biggs' 3P Model of Teaching and Learning. Biggs' work throughout the past half-century has been a detailed exploration of a model of teaching and learning which incorporates a constructivist approach to teaching and learning. The 3P Model of Teaching and Learning accounts for three distinct phases of learning: presage, process, and product.

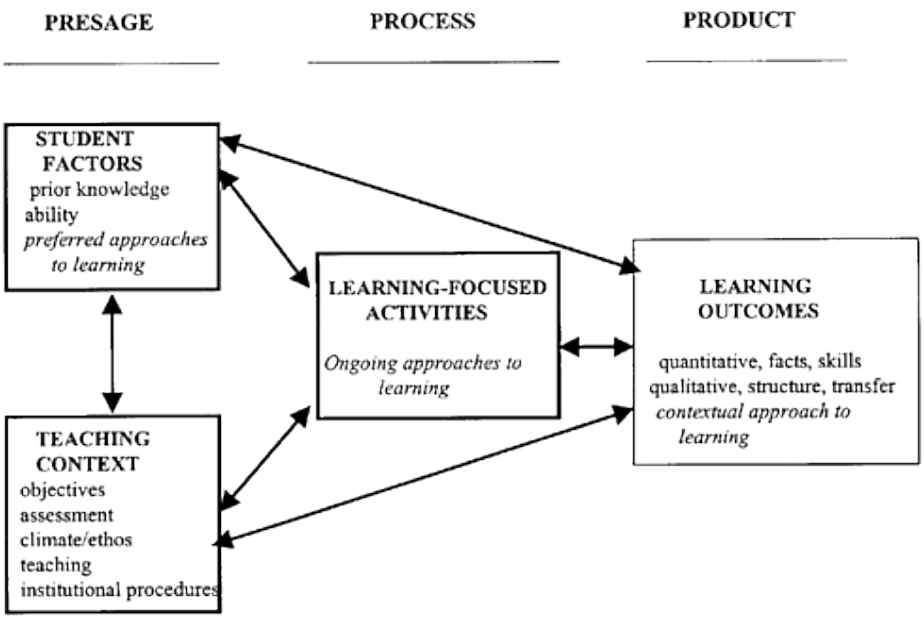


Figure 1. Biggs' 3P Model of Teaching and Learning. Reprinted from "The revised two-factor Study Process Questionnaire," by J. B. Biggs, D. Kember, and D. Y. Leung, 2001, *British Journal of Educational Psychology, 71,* p. 136. Copyright 2001 by the British Psychological Society. Reprinted with permission.

Biggs' illustration (see Figure 1) depicts a model of teaching and learning where the specific components are not independent of each other. In the 3P Model of Teaching and Learning, the learning environment is constructed in such a way that promotes clear learning outcomes, alignment of assessments, and considers the student as an active learner, one who influences and is influenced by the process of teaching and learning (Hattie, Biggs, & Purdie, 1996).

A critical task that needs to be addressed before learning takes place in Biggs' 3P model is to identify intended learning outcomes, which provide the student with expectations as well as inform the method of instruction. Outcomes-based education (OBE) is not new to higher education (Biggs, 1999; Tam, 2014). Tam (2014) called attention to the student-centred aspect of OBE, which "is the idea that teachers are facilitators of learning, who create and sustain an effective learning environment and

experience based on a wide range of best practices in teaching and learning" (p. 161). The idea of using intended learning outcomes to guide the development of teaching strategies and assessment "is old – it is criterion-referenced assessment", which creates an environment where students are set up for success, instead of subjective evaluation (Biggs & Tang, 2011, p. 98).

One criticism of relying on learning outcomes is the perception that they are being thrust upon education as a quality assurance measure (Spady & Marshall, 1991). This may be true of OBE depending on whether outcomes are based primarily on an administrative view of education, or whether they have been drafted in relation to learning outcomes at other levels (e.g., institutional, program, course, and lesson). For intended learning outcomes to be successful, they must address "an educational need … something individuals should learn for their own good, for the good of their organization or profession, or for the good of society" (Knowles, 1970). They also must be observable, measurable, and within the capabilities of the student's potential (Biggs, 1999).

A second criticism of OBE is that it erodes the professional responsibility of educators by placing disproportionate weight on what the student does (Donnelly, 2007). As I suggested earlier, this depends entirely on if students are engaging in postsecondary studies to *be taught* or to *learn* (Barr & Tagg, 1995). My research, aligning with Biggs' (1999) view that learning is dependent on the actions of the student to inform teaching, means that intended learning outcomes are a critical component to the learning process as a result.

Significance of the Study

The question *so what?* is being asked increasingly when it comes to research about teaching and learning in higher education (Shank, Brown, & Pringle, 2016). In other words, the *so what* is a direct way of asking for the practical rationale of a research study. I believe this question is important for me as a beginning researcher and as someone who subscribes to a constructivist approach to education, because it forces me to think critically about the potential ramifications of my research.

Boyer (1990) described scholarly teaching as a "dynamic endeavor involving all the analogies, metaphors, and images that build bridges between the teacher's understanding and the student's learning" (p. 23). One of the qualities of the scholarship of teaching and learning (SoTL) is a need to better understand the processes of teaching, so as to be a reflective practitioner and provide teaching experiences that lead to learning. On the other hand, Boshier (2009) suggested that SoTL is marred by a series of factors which inhibit its widespread acceptance, notably due to the perception of a hierarchical set of influences on university education. Neoliberalism has influenced scholarship, as "leisurely approaches to intellectual work have been replaced by just-in-time scholarship" and "articles in reputable journals are the coin of the academic realm" (Boshier, 2009, p. 8-9). If high quality teaching positively influences student perceptions of learning—as Trigwell, Prosser, and Waterhouse (1991) argue—then it is important for my research to be clear; the results add to a discussion of teaching and learning as it relates to an authentic student experience. In other words, this study highlights the symbiotic relationship between teaching and learning in a way that puts student learning above neoliberal ideals of institutional productivity and transactional education.

Currently, there are 20 universities in Ontario that have active centres of teaching and learning, all of which conduct some sort of research, institutional or otherwise. The specific focus of my research on student approaches to learning aligns itself with the current research trends designed to understand the student experience as it exists in the learning paradigm, where students are actively involved in their education. Despite this, there have been few documented studies investigating student approaches to learning in Ontario. In a search of multiple online databases (i.e., ERIC, ProQuest, Web of Science, and APA PsycNET) using combinations of the words "student," "approach," "learning," "Canada," "Ontario," "Study Process Questionnaire," and "R-SPQ-2F," only a handful of studies were found which roughly align with my study in purpose, scope, and method (Acai & Newton, 2015; Evans, Kirby, & Fabrigar, 2003; Kirby, Silverstri, Allingham, Parrila, & La Fave, 2008; Wiese & Newton, 2013). It cannot be assumed that the lack of published research studies investigating student approaches to learning equates to the absence of research in practice. Perhaps instead, individual educators are investigating student approaches to learning as a means of "[monitoring] their teaching from class to class, or [following] some innovation in teaching or assessment in an action research design" (Biggs et al., 2001, p. 7). A valid reason to investigate student approaches to learning is to collect student feedback on individual teaching, but it is not the only one.

My study provides evidence of student approaches to learning and conceptions of learning from a wider student population than the individual classroom. The analysis of student approaches to learning can be useful to instructors to assess their teaching, and to administration to help understand and quantify academic aspects of the student experience. A larger cross-section of student learning approach identification also

benefits educational developers, tasked with faculty development, course design, and instructional design.

CHAPTER 2: LITERATURE REVIEW

Before researching how students are approaching learning within the context of their university experience, I will investigate and clarify some fundamental topics. The first concept that needs to be analyzed is *learning* itself. The present literature review provides insight into the following topics: student learning research, constructivism, student approaches to learning (SALs), and undergraduate teaching and learning. These topics are discussed in order to provide clarity and context for my research study.

I begin my literature review by briefly exploring a fundamental question: *what is learning*? Taking into account foundational texts from educational psychologists, empirical research studies, and constructivist frameworks, learning will be broadly defined for the purposes of my research project. After suggesting a working conception of learning, an introduction to student learning research will be provided. Next, I will identify seminal research studies which have shaped student learning research into the burgeoning field it has become. A brief history and critique of the basic ideas of student learning research will round out the discussion, leading to the emergent measurement unit of learning: the student approach to learning. Student approaches to learning will be explored in depth, both in theory and practice, with connections to current literature using learning approaches as a means of observation to understand teaching and learning. An overview of survey instruments designed to investigate student approaches to learning is included. Special attention will be drawn to the Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) (Biggs et al., 2001), which is one of the most commonly-used survey instruments, and the one used in my study. Finally, learning, student learning research, and student approaches to learning will be contextualized within postsecondary

undergraduate education. Two of the dominant educational paradigms (i.e., instruction paradigm, learning paradigm) will be compared and contrasted, with a justification of the learning paradigm presented in order to promote the constructivist notion of teaching and learning. Though few exist, connections to Canadian examples will be highlighted where possible throughout the literature review, as my study will hopefully be counted among them.

What is Learning?

So, what, exactly, is *learning*? This is a question to which everyone could provide some sort of answer, as everyone has learned *something* in their life, academic or otherwise. If my research is to investigate learning in-depth, there must be some working conception of what learning is, or ought to be, in order to measure it in some capacity.

There are major differences between the cognitive levels of adults and children, resulting in significantly different learning experiences and educational needs. By the time learners enter university, many are at the concrete operational or formal operation stages of Piagetian cognitive development (Woolfork, Winne, & Perry, 2015). They also, however, bring with them a wider set of experiences, usually resulting in a mature individual (Delahaye, Limerick, & Hem, 1994). Knowles (1973) explains that:

> As an individual matures, his need and capacity to be self-directing, to utilize his experience in learning, to identify his own readiness to learn, and to organize his learning around life problems, increases steadily from infancy to pre-adolescence, and then increasingly rapidly during adolescence. (p. 43)

Because of the variety of backgrounds adult learners bring to the learning experience, adult learning theories are not as well defined than those of children.

Since the beginning of serious research into adult learning almost 100 years ago, still "we have no single answer, no one theory or model of adult learning that explains all that we know about adult learners" (Merriam, 2001, p. 3). In an attempt to differentiate adult learners from child learners, Knowles (1968) devised a "new label and a new technology" for adult learning: *andragogy* (p. 351). Fundamentally different than young students, Merriam (2001) posits that the adult learner:

1) has an independent self-concept and who can direct his or her own learning;
2) has accumulated a reservoir of life experiences that is a rich resource for learning;
3) has learning needs closely related to changing social roles;
4) is problem-centered and interested in immediate application of knowledge; and
5) is motivated to learn by internal rather than external factors. (p. 5).

Merriam's (2001) assumptions about the adult learner are important to consider, as university students should be seen as adult learners who are engaged in self-directed learning in their undergraduate studies. Brookfield (1984) cautions, however, that adult learning research needs to be more diverse by recruiting participants from a broader demographic, accepting qualitative research methods, considering the social context of learning, and accounting for the social and political implications of adult learning.

The question *what is learning?* becomes a loaded question when one's belief of the purpose of education is factored into the answer. One longstanding yet highly scrutinized purpose of education focuses on the dissemination of knowledge to teach content (King, 1993). Teachers are seen as content experts who pass on information to students through lectures and the passive transmissions of knowledge that Dewey (1938)

called “a finished product, with little regard either to the ways in which it was originally built up or to changes that will surely occur in the future” (p. 5). For others, such as Tyler (1933), the purpose of education is to allow students to satisfy a specific set of career-based objectives. Freire (2005) envisioned education as liberating, allowing the marginalized to overcome the logic of the current system in which they find themselves. Furthermore, the Indigenous peoples of Canada see education as a process which facilitates an understanding of the world through “a clear connection to Indigenous Knowledges shared inter-generationally by knowledge holders and Elders through storytelling and place-based poetic writing” (Kulnieks, Young, & Longboat, 2013, p. 70). There are numerous other views on the purpose of education (e.g., to perpetuate neoliberalism, to create good citizens, etc.), and it follows then that a learner’s view of the purpose of education will undoubtedly affect how they define learning.

The purpose of education also influences a teacher’s teaching perspective. Consider the *Teaching Perspectives Inventory* (TPI), an instrument designed by Pratt and Collins (2000) designed to identify the dominant teaching perspective of an educator. Five teaching perspective categories have been identified as a result of much research completed by Pratt (1992, 1998) as well as Kember (1997): transmission, apprenticeship, developmental, nurturing, and social reform (Pratt & Collins, 2000). Educators respond to questions probing their beliefs, intentions, and actions, and their responses are assessed to provide a dominant teaching perspective.

These perspectives seem strikingly related to a number of the purposes of education I just mentioned. This is because a teaching perspective and a teaching approach are different. Consider the perspectives (i.e., transmission, apprenticeship,

developmental, nurturing, social reform) analogous to vacation destinations. Some people like to travel to Mexico, others to Italy, others to India, Alaska, and Argentina. But how is the traveller going to get there? The mode of transportation is representative of an instructor's approach to teaching. The traveller (student) could take an airplane and quickly bypass the space between the two destinations. Or they could take a minivan or a motorcycle, spending time going through every little town on the way. Those little pit stops are important and memorable, just as the joys and trials of the learning process are.

The majority of early research on student learning was conducted by educational psychologists from a few key areas on the world: Sweden, Australia, Hong Kong, and the United Kingdom. While these studies have formed the foundation of student learning research, little is known about the participants in the studies beyond their level of study and educational program, and less frequently, their age. Even less is documented about the communities where the research took place, other than the obvious cultural associations of the geographic locations. The lack of diversity is important when considering the cultural differences related to learning, specifically adult learning (Brookfield, 1984). Lund (2004) identified that Confucian-influenced Asian societies have two significant cultural norms that conflict with Western views of textual citation: the reverence of a leader's words, and the inability to question the authority of those words. Consequently, some international students from these countries occasionally use the text or spoken words of a cultural leader verbatim, in order to pay respect to the leader (Lund, 2004). However, Kember (2000) suggests this stereotype is actually a trait of Western students as there is also need for academic integrity training for Western students. The practice of "Othering" students does not take into account what students

actually say and do, but only presumes that their learning fits the stereotypes (Grimshaw, 2007). Understanding students as learners is critical, but broadly painting cultural groups with the same brush is not.

One of the first documented studies to investigate the definition of learning was undertaken by Martin and Säljö (as cited in Säljö, 1979). In their study, participants engaged in an initial interview, read a text, answered questions about the process they used to learn the information in the text, and were involved in a short discussion. The 90 participants' identities are vaguely described as being between the ages of 15 and 73, with educational backgrounds of 6 to 16 years, all in social psychology (Säljö, 1979). From the answers provided to the question "what is learning?" Säljö (1979) identified five basic categories in which to sort conceptions of learning: (a) an increase in knowledge (merely a synonym for the word learning), (b) memorizing, (c) an acquisition of facts or principles which can be retained and used in practice, (d) an abstraction of meaning, and (e) an interpretive process aimed at understanding reality. Säljö's study sparked a number of educational psychologists to research the context of learning. In general, most found their results mapped on to Säljö's (1979) original findings (Marton, Dall'Alba, and Beaty, 1993; van Rossum and Schenk, 1984).

As research became more diverse in terms of the participants of these studies, variations of Säljö's original list of categorical conceptions of learning began to emerge. Marton et al. (1993) found that in their study of the learning views of 29 British university students, a sixth category of learning conception was prevalent: "changing as a person" (p. 292). This sixth conception of learning "builds on an existential aspect to learning" (Marton et al., 1993, p. 292), suggesting that learning affects change in a

person's beliefs and actions. Validation for the sixth conception of learning emerged finding is that another pair of researchers (van Rossum & Taylor, 1987).

These six categories of conceptions of learning stayed relatively constant for the next decade or so, until a study conducted by Purdie, Hattie, and Douglas (1996) investigated Australian and Japanese conceptions of learning in order to relate them to participant-identified learning styles. While their findings included Säljö's (1979) list of five and the list of six from Marton et al. (1993), participants also conceptualized learning as: "a duty; a process not bound by time or context; and developing social competence" (Purdie et al., 1996, p. 95). These three distinct categories were acknowledged as minority viewpoints by Purdie et al. (1996), with the exception of "a process not bound by time or context" (p. 95). Context being disregarded as part of the learning process is problematic from a constructivist perspective because when looking at student learning through a constructivist framework, the context of learning is influential on the approach students take to their learning. However, these conceptions are qualitative in nature, and the views of the participants are entirely valid in qualitative research (van den Hoonaard, 2012).

After an investigation of some impactful studies on the conceptualization of learning, a list of seven categories of conceptions has emerged. The studies I have selected come from similar conceptions of student learning research and are by no means exhaustive, but they do consider a number of diverse participants. These categories are not exhaustive, but rather those which are supported by evidence from published research studies, and are supported by the theoretical framework of this research and my

positionality as a researcher. Therefore, this list of seven types of conceptions of learning will form as the basis for the conceptualization of learning in the present study:

Table 1

List of Conceptions of Learning

Conceptions of Learning	Influence
a) An increase in knowledge;	Säljö (1979)
b) Memorizing and reproducing;	Säljö (1979)
c) An acquisition of facts or principles, which can be retained and used in practice;	Säljö (1979)
d) Understanding / abstraction of meaning;	Säljö (1979)
e) An interpretive process aimed at understanding reality;	Säljö (1979)
f) Changing as a person;	Marton, Dall'Alba, and Beaty (1993)
g) A process not bound by time or context;	Purdie, Hattie, & Douglas (1996)

Note: Adapted from "Student conceptions of learning and their use of self-regulated learning strategies: A cross-cultural comparison" by N. Purdie, J. Hattie, and G. Douglas, 1996, *Journal of Educational Psychology, 88,* p. 95. Copyright © 1996 by the American Psychological Association. Adapted with permission.

The identification of thematic conceptions of learning provided Säljö clarity in terms of how to conceptualize learning, but these findings do not fully satisfy the question of the quality of learning. After his lengthy study, Säljö (1979) still found himself pondering a deeper question:

> If we claim that experience of learning may lead to a thematization of learning, does this have anything to do with learning performance? Clearly, this is not something which can be answered here. My guess, however, is that this is indeed the case in the sense that when people become aware of their own learning in different respects, they will be better equipped to deal with various sorts of learning difficulties, such as those described by Marton and Säljö (1979). They may not become better learners within the context of a psychological laboratory

> with its constrained meaning of the concept of learning, but I do think that they will become better at handling learning and reading problems of the kinds encountered in everyday life, or at least, in everyday studying. This is a question we are currently examining in our research. (p. 451)

What is clear from Säljö's preceding response is a need to understand not only a learner's conception of learning, but describe a learner's learning process in some way.

Constructivism. Constructivism provides such a theoretical framework to contextualize the learner's learning experience, as well as an instructor's actions and reflection. Constructivism, as defined by Davis, Sumara, and Luce-Kapler (2000) is "the premise that the learner's basis of meaning is found in her or his direct experience with a dynamic and responsive world" (p. 65). Potter (2013) made parallel connections, and suggested that learning "is helped or hindered by context" and that "[ideas are] best learned in an "authentic" context, that is, a situation in which all of the factors that would affect its use beyond the classroom are present" (p. 3). When recalling the list of conceptions of learning guiding this research, there is a clear division between those conceptions which uphold the constructivist notion of learning, and those which do not. Table 2 identifies the two groups of conceptions of learning.

Table 2

Conceptions of Learning within the Constructivist Framework

Conceptions of Learning	
a) An increase in knowledge; b) Memorizing and reproducing; c) An acquisition of facts or principles, which can be retained and used in practice;	Non-constructivist
d) Understanding / abstraction of meaning; e) An interpretive process aimed at understanding reality; f) Changing as a person; g) A process not bound by time or context;	Constructivist

Note: Adapted from "Student conceptions of learning and their use of self-regulated learning strategies: A cross-cultural comparison" by N. Purdie, J. Hattie, and G. Douglas, 1996, *Journal of Educational Psychology, 88,* p. 95. Copyright © 1996 by the American Psychological Association. Adapted with permission.

Potter (2013) championed the necessity for constructivism to be the "dominant learning philosophy – in fact, even the dominant epistemology – in the Scholarship of Teaching and Learning (SoTL) and Educational/Academic Development communities" (p. 3). His notion of constructivism aligns with earlier thinking, whereby "a) knowledge is actively constructed by each person through a complex interplay of experiences, and b) because of that, education should focus on providing people with the means, conditions, and facilitation necessary to help them actively construct their own knowledge, ideas, beliefs, models, and meaning" (Potter, 2013, p. 3).

Biggs' (1996b) 3P Model of Teaching and Learning addresses concerns of constructivist thinking by suggesting that learning can be understood through a set of educational development strategies which when implemented together allow for the best opportunity for learning. The 3P Model of Teaching and Learning (recall Figure 1) supposes learning to be the measureable, observable change in a student's cognitive, behavioural, or affective faculties, as related to learning outcomes in the given learning context. Biggs (1999) suggests there are two types of students: "Academic Susan", and "Non-academic Robert" (p. 59).

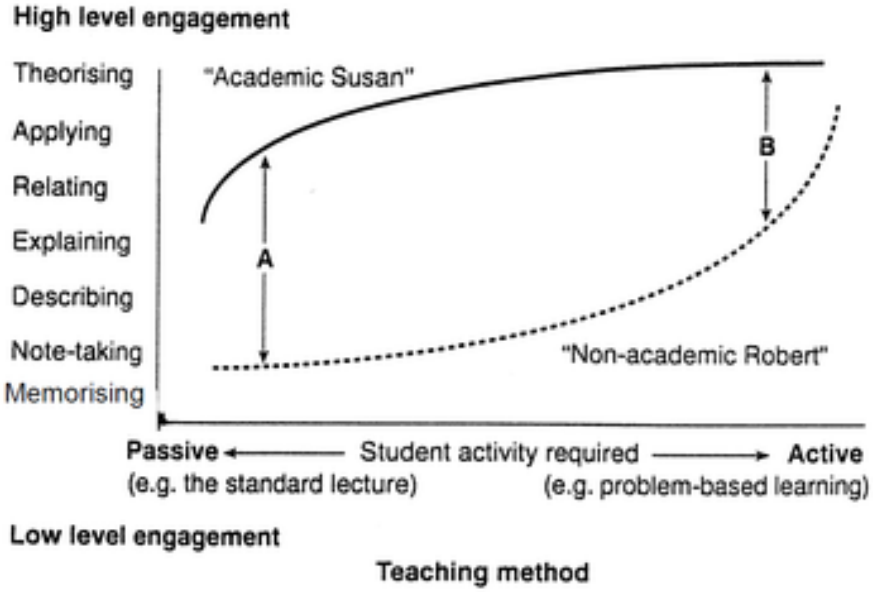


Figure 2. Academic Susan and Non-academic Robert. Reprinted from "What the student does: Teaching for enhanced learning" by J. B. Biggs, 1999, *Higher Education Research & Development, 18,* p.59. Reprinted with permission. Copyright 1999 by Routledge.

The two students depicted in Figure 2 can be seen as taking deep (Susan) and surface (Robert) approaches to learning. Their learning is affected by both their level of engagement, as well as the degree of student activity demanded by the teaching methods they are exposed to. It was evident to Biggs (1999) and likely to many university

professors, that there are more Roberts than Susans. Herein lies the heart of Biggs' 3P model – that learning experiences that are deep should be encouraged.

Biggs and colleagues have devised a number of theories to promote deep learning. Constructive alignment is a systematic approach to designing learning experiences where teaching methods, student activities, and assessments align (Biggs 1996a). It is a specific approach to the backwards design method of course design, which begins by identifying the end result of learning, the intended learning outcomes of the lesson, unit, or course. The intended learning outcomes become the first priority, guiding the rest of the development process. Ideally, the learning outcomes should consider the cognitive, performative, and affective domains (i.e., knowledge skills, and attitudes), asking students to engage in higher-order thinking and make connections to life beyond the classroom (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). Solidifying learning outcomes at the outset of designing a course helps to then inform the teaching methods used to help students achieve them. For instructors who strive for good teaching, it isn't enough to say "I taught the students, but they didn't learn" (Biggs & Tang, 2011, p. 19).

Rather, effective teaching is predicated on adopting an integrated view of the student and teacher. Unlike the deficit mentality of teaching noted above, a learning-centred approach to teaching supposes that effective teaching takes into account *what the student does* rather than what the teacher does, or solely the identity of the student. When learning outcomes are explicitly communicated to students, their perception of the learning environment changes. Sadler (2005) believed that "at the point of beginning a course of study, students deserve to know the criteria by which judgments will be made about the quality of their work…and use the information to shape their work intelligently

and appropriately while it is being developed" (p. 178). For these reasons and others, the 3P Model of Teaching and Learning has become a revered model of learning in the eyes of engaged educators, SoTL scholars, and educational developers.

Student Learning Research

In light of the preceding discussion about student learning, which is extensive, but by no means exhaustive, this review will shift into a discussion of student learning research. According to Entwistle (1984), "teachers look to psychologists for explanations of fundamental principles of learning… but much of the early work in experimental psychology involved attempts to uncover general principles of learning" (p. 5).

Student learning research was initially structured similarly to other psychological research: planned experiments in controlled environments. While these methods might be acceptable to answer many psychological questions, the concept of student learning was a different one, because context is crucial to understanding how it is that a student learns. Classrooms are not the same as they once were. Biggs (1999) reflects on the recent past in the same way, accusing psychologists of being "more concerned with developing 'The One Grand Theory of Learning,' than in studying the contexts in which people learn, such as schools and universities" (p. 59). These sentiments were the driving force behind the shift in student learning research from a paradigm which seeks to predict student ability (e.g., student aptitude testing) to a more descriptive paradigm, seeking to investigate the actual experience of students in classroom settings. When compared to constructivist conceptions of learning (i.e., learners making meaning by engagement), this paradigm provides alignment with the suggested theoretical framework and the research paradigm.

Research into student learning using a descriptive paradigm rose to the forefront with a seminal study by Marton and Säljö (1976a), two Swedish educational psychologists who were interested in understanding qualitative difference in learning. Marton and Säljö's (1976a) study was unique in its aims; the study sought to describe students' experiences through the collection of qualitative datasets, rather than continually test students in an experimental setting as had been done for decades (Entwistle, 1984). In the study, Swedish undergraduate students from educational psychology were asked to read a newspaper article about curriculum reform in Swedish universities. After reading, students were asked to summarize the article in two sentences, with answers categorized into four levels. When students were re-tested five weeks later, the level of student answers had declined in nearly every case (Marton & Säljö, 1976a).

Along with each answer, students were asked to answer introspective questions describing how they processed the article, to learn and remember its content. Marton and Säljö (1976b) deliberately asked students to recount how they had handled the learning task and how it appeared to them. From the student responses, it was found that most students approached their task using "*surface-level*" or "*deep-level*" processing, though some identified aspects of both processing levels (Marton & Säljö, 1976a, p. 9). Results from that study also showed that there was relationship between how a student approached the task and the quality of their summary report. The study included some of the first results that expressly linked students' learning habits with their level of processing.

The identification of unique levels of processing by Marton and Säljö (1976a) also identified a distinction between what students focused on while engaged in learning activities. For those students who used surface-level processing, their focus was on *the sign*, the literal information of the text. Those students who were engaged in deep-level processing were found to be engaged with *the signified*¸ or more broadly speaking, the meaning and implications of the text. Deep-level processing aligns with learning through a constructivist framework.

Those originally concerned with student learning (e.g., Marton, Säljö, Entwistle, Biggs, etc.) agreed that it be imperative to understand how the student learns. However, there became nuances in the thinking of different groups of educational psychologists. Entwistle was working from the "psychology of individual differences" (i.e., differential psychology) (Biggs & Tang, 2011, p. 22), Biggs from cognitive psychology, and Marton and Säljö from what has eventually come to be known as phenomenography (Marton, 1981). While all were studying learning within an institutional context, it was Biggs whose constructivist approach placed SALs into a larger model of learning, by hypothesizing that constructivism "emphasizes what students have to do to construct knowledge, which in turn suggests the sorts of learning activities that teachers need to encourage" (Biggs & Tang, 2011, p. 22). Neither differential psychology (the study of differences between individuals or groups) nor phenomenology can connect student learning to teaching approach as concretely.

Marton (1981) approached student learning research from the "second-order perspective" (p. 177). He called this perspective phenomenography, which was a term he borrowed from Sonneman's (1954) clinical psychology vocabulary. For Marton (1981),

phenomenography was "research which aims at description, analysis, and understanding of experiences; that is, research which is directed towards experiential description" (p. 180). Not to be confused with phenomen*ology*, which is concerned principally with understanding an event or phenomenon, phenomen*ography* is concerned with understanding the perceptions people have of the situation or phenomenon, in order to learn something about it. It is the second-order perspective Marton (1981) spoke of that forms the basis for his student learning research. The implications of phenomenography, according to Prosser and Trigwell (1999), however, are that outcomes-based learning is only effective if the student's perceptions are changed to align with that of the teacher. Herein lies a fundamental distinction between phenomenography and constructivism, which provides a stronger basis for outcomes-based learning, and is one reason why my study is not taking a phenomenographic approach.

The qualifiers deep and surface quickly became the terms used to describe two distinct methods of student processing. Many researchers began using the same terminology, and investigating learning in this way (Biggs, 1979; Laurillard, 1978; Ramsden, 1981; Ramsden & Entwistle, 1981). The next portion of this literature review explores *student approaches to learning* (SALs).

Student Approaches to Learning

The concept of a student approach to learning resulted from years of research investigating the quality and quantity of student learning. The previous section of this review identified many of the key contributors to the ever-growing body of student learning research. By building on this foundation, it was realized that "meaning is not imposed or transmitted by direct instruction, but is created by the student's *learning*

activities" (Biggs, 1999, p. 60). The next section identifies the positionality of some of the key researchers, and will discuss in detail SALs from the constructivist perspective, through an analysis of Biggs' work (Biggs 1979, 1987a, 1987b, 1996b, 1999; Biggs et al., 2001; Biggs & Tang, 2011).

Entwistle and Tait (1990) found themselves looking at the educational environment in the United Kingdom and realizing that there were further categorizations in the results of their experiments. Their research identified multiple subscales beyond the deep and surface approaches (Entwistle & Tait, 1990). The subscales are reflected in the *Learning and Studying Questionnaire* (LSQ) and the *Experiences of Teaching and Learning Questionnaire* (ELTQ) (Entwistle, McCune, & Hounsell, 2013), as well as the *Approaches and Study Skills Inventory for Students* (ASSIST) instrument (Entwistle McCune, & Tait, 2013). For the purposes of my research, the 60-item ASSIST instrument is not feasible to distribute, given the scope of the project. Their instruments also have not been designed with constructivism as the main lens.

Biggs and others in Australia, however, became increasingly concerned with studying approaches to learning as part of a larger contextual understanding of learning. Biggs' conception of SALs was influenced by the framework of constructivism, where education is about conceptual change; when learning outcomes are clear, students experience a felt need to achieve outcomes, can freely focus on tasks, and can collaborate (Biggs & Tang, 2011). Biggs' (1985) early conception of student approaches to learning as "motive-strategy packages" (p. 128) was evident in the language used in the subscales of the R-SPQ-2F. Thinking about motives and strategies is also reflected in the levels of teaching competence Biggs (1999) identifies, where the paramount level of teaching is

concerned with *what the student does*, the systemic view which takes into consideration the entire learning experience outlined in the 3P model (Biggs, 1996b).

A *deep approach* (DA) to learning is categorized as an "intention to understand, with use of evidence and relating of ideas as the predominant strategies, and interest in ideas as the predominant motive" (Diseth, 2007, p. 187). Many students who take a deep approach find what they are learning interesting, and often go beyond the minimum requirements to pass a course, or achieve a high mark. These students incorporate self-starting study habits. Contrastingly, the *surface approach* (SA) is defined as reproduction. Students work to memorize and replicate information, as a means to the end they desire (pass the course, achieve an "A" grade, etc.). They often do not engage with material beyond the literal meaning. It is important to differentiate that a student's approach to learning is not permanent nor a part of a student's identity, but a measure of a student's perception of their learning environment. Another look at the list of conceptions of learning from earlier in this chapter suggests that they can be aligned with learning approaches.

Table 3

Conceptions of Learning Grouped by SAL Influence.

Conceptions of Learning	
a) An increase in knowledge; b) Memorizing and reproducing; c) An acquisition of facts or principles, which can be retained and used in practice;	Surface
d) Understanding / abstraction of meaning; e) An interpretive process aimed at understanding reality; f) Changing as a person; g) A process not bound by time or context;	Deep

Note: Adapted from "Student conceptions of learning and their use of self-regulated learning strategies: A cross-cultural comparison" by N. Purdie, J. Hattie, and G. Douglas, 1996, *Journal of Educational Psychology, 88,* p. 95. Copyright © 1996 by the American Psychological Association. Adapted with permission.

What can be gleaned from Table 3 is that conceptions of learning and student approaches to learning relate to each other theoretically. My study investigated this relationship through the second research sub-question of this study (*Do participants' dominant approaches to learning align with their definitions of learning?*). While assumptions could be made, they would be premature to do in the environment being researched because there is no evidence to make these assumptions. My study provides a pool of rudimentary data to investigate that very connection.

The Study Process Questionnaire (SPQ) and the Revised Two Factor Study Process Questionnaire (R-SPQ-2F)

One of Biggs' (1979) contributions to the study of student approaches to learning was the *Study Process Questionnaire* (SPQ). The SPQ instrument was designed to collect the self-identified approaches to studying of tertiary students, and using identified factors (surface, deep, and strategic), produce average scores for the factors. The

dominant factor identified the dominant learning approach, which could be used for any of the purposes discussed earlier in this section of the literature review. The SPQ was published with instructions for use (1987a), encouraging instructors to use it as a means of understanding student perceptions of the learning environment through their self-identified study habits.

In 2001, Biggs, Kember, and Leung revised the SPQ into the *Revised Two-Factor Study Process Questionnaire*, or R-SPQ-2F. They understood that university education had changed since the SPQ was created, and that there were questions which were no longer as necessary as before. Instructors and researchers has begun using the SPQ as a tool to label students, and it was thought by Biggs to be "quite inappropriate to categorise students as surface or deep learners on the basis of SPQ responses, as if an approach score measured a stable trait" (Biggs et al., 2001, p. 5). The R-SPQ-2F is significantly shorter than the SPQ, and removed the contested "strategic" approach as a factor. The R-SPQ-2F has been modified by Kember, Biggs, and Leung (2004) into the LPQ, a similar instrument designed for secondary school implementation.

The SPQ and R-SPQ-2F have been used extensively in research since their creations (see, for instance, Fox et al., 2001; Gow & Kember, 1990; Hall, Bolen, & Gupton, 1995; Kember, Wong, & Leung, 1999; Zeegers, 2001). While the SPQ is still a valid instrument, its usage has declined since the inception of the R-SPQ-2F. One possible reason for the SPQ's decline is the brevity of the R-SPQ-2F, with only 20 Likert-like questions, administration of the R-SPQ-2F takes less than half the time to administer. As an educator, the straightforward implementation of the R-SPQ-2F is an

attractive feature, and could be a good component of a mid-course feedback plan. Specific instrumentation is discussed in the next chapter.

There have been a large number of studies that have utilized the R-SPQ-2F in recent years, likely as a result of the instrument's increasing publication frequency. Much of the research using the R-SPQ-2F has been quantitative in nature, designed to understand the learning experiences of students from a specific academic program of a diverse or specific background or to replicate the methods of Biggs et al. (2001), in order to assess the validity, reliability, and factor structure of the R-SPQ-2F.

Table 4

Research Studies Using the R-SPQ-2F

Author(s)	Date	Primary Focus of Study			
		Academic Discipline	Student Population	Instrument Psychometrics	Teaching Method
Acai & Newton	2015				✓
Alauddin & Ashman	2014		✓		
Balasooriya, Tetik, & Harris	2011	✓			
Biggs, Kember, & Leung*	2001			✓	
Çetin	2015		✓		
Çetin	2016	✓			
Clinton	2014	✓			
Duff & McKinstry	2007	✓			
Fryer, Ginns, Walker, & Nakao	2012			✓	
Gijbels et al.	2005	✓			
Immekus & Imbrie	2010		✓		
Justicia et al.	2008			✓	
Kyndt, Cascallar, & Dochy	2012				✓
Kirby et al.	2008				✓
Lake & Boyd	2015		✓		
Lake, Boyd, & Boyd	2015	✓			
Mogre & Amalba	2014			✓	
Newton & Martin	2013	✓			
Smith	2005		✓		
Socha & Sigler	2014			✓	
Stes, De Maeyer, & Van Petegem	2013		✓		
Tural Dincer & Akdeniz	2008		✓		
Wiese & Newton	2013				✓
Wilson & Fowler	2005	✓			

Note: Biggs, Kember & Leung (2001) are the creators of the R-SPQ-2F.

At the University of Guelph, Wiese and Newton (2013) used the R-SPQ-2F as a means of assessing the relationship between student approaches to learning and exposure to lecture capture in a biological sciences course. They subjected one class of students to a course design which included lecture capture, and another to a course design which did not utilize lecture capture. They found that “significant relationships were observed between viewing behaviour and learning approach” (Wiese & Newton, 2013, p. 9).

When cross-referencing the R-SPQ-2F results with their supplementary questions about lecture capture habits, they found that students who identified a deep approach were watching videos in their entirety, for content mastery, and to review material, while those students who identified a surface approach would not complete video viewing, and were not likely to take notes from the videos. Wiese and Newton's (2013) research highlighted the effective use of the R-SPQ-2F as a tool to assess and refine undergraduate teaching. Wiese and Newton (2013) advocated that "a primary objective of evidence-based investigations such as this one is to demonstrate strategies and tools with which to improve student learning; it is our belief that this goal has been accomplished in the present study" (p. 20).

The present study used statistical analysis to assess the validity and reliability of the R-SPQ-2F in the Canadian context. Assessing the validity and reliability of the R-SPQ-2F is not the sole purpose of my study, but it is a necessary procedure that aids in inferring meaning from student responses. Socha and Sigler (2014) investigated the psychometric analyses of three studies (Biggs et al., 2001; Immekus & Imbrie, 2010; Justicia et al., 2008). After careful examination, it was reported that the two-factor structure of the R-SPQ-2F is present, despite one study (Immekus & Imbrie 2010) disagreeing with the two-factor structure. The current research has relied on the collegial nature of others such as Socha and Sigler (2014) when selecting the R-SPQ-2F as the instrument of choice.

A psychometric study by Immekus and Imbrie (2010) attempted to validate and cross-validate the factor structure of the R-SPQ-2F using two cohorts of students at a large, midwestern university in the United States (cohort 1: n=1490, cohort 2: n=1533).

The first cohort was split in half to test the fit of "a first-order, four-factor model" (Immekus & Imbrie, 2010, p. 499) and the theoretical two-factor model outlined by Biggs, Kember and Leung (2001). Results indicated that neither the theoretical two-factor model nor the first-order four-factor model met the statistical criteria for acceptance, so exploratory factor analysis (EFA) was employed. After a full investigation of the psychometric properties of the R-SPQ-2F was completed, Immekus and Imbrie (2010) found that the four-factor structure was present, but the two-factor structure was not. What seemed like a negative blow to the R-SPQ-2F, however, was refuted by Socha and Sigler (2014), who suggested that the results of Immekus and Imbrie (2010) did not make sense conceptually. The takeaway from Immekus and Imbrie (2010) is a lesson in survey research: the respondents of the survey matter.

Disciplinary roots can affect learning approaches measured by the R-SPQ-2F, specifically surface approaches and the surface subscales (Lake, Boyd, & Boyd, 2015; Ramsden, 1981). Lake et al. (2015) used the R-SPQ-2F to identify the differences in learning approaches between undergraduate students from art-based disciplines and science-based disciplines. They found that on average, both groups of students had higher deep approach scores than surface approach scores. However, the gap between deep and surface average scores was much smaller with the science students, because "science students are more likely to stress an over-concentration on techniques and procedural details, which promote a surface approach" (Lake et al., 2015, p. 1739).

The R-SPQ-2F is robust in design and purpose. It was an ideal instrument for my study because of its widespread use, and its support of constructivist approach to

learning. Of course, the conditions of this instrument's use play a role in the effectiveness of its ability to suggest change in a teaching and learning environment.

Undergraduate Teaching and Learning

Much of my literature review has been an in-depth introduction to contextualizing learning, understanding approaches to learning, introducing literature relevant to my study, and explaining the survey instrument, both in design and practicality. The last section of my review is a modest attempt to contextualize all of that into the undergraduate learning context. An attempt to briefly relate undergraduate education paradigms and teaching culture to student approaches to learning will conclude my review.

A paradigm "is like the rules of a game: one of the functions of the rules is to define the playing field and domain of possibilities on that field" (Barr & Tagg, 1995, p. 3). There are two dominant paradigms in undergraduate education: the *teaching* or *instruction paradigm*, and the *learning paradigm* (Barr & Tagg, 1995). These two paradigms employ different pedagogies and promoting seemingly opposite outcome of education. While elements of the two paradigms could become intertwined, Barr and Tagg (1995) illustrate a dichotomy, based on research and their personal experiences as university educators.

The *teaching paradigm* is what many think of when they think of undergraduate education. The focus in the teaching paradigm is the transmission of information. Transmission of knowledge is achieved by teacher-centred pedagogies: lecture, presentations, and heavy reading, assessed by high-stakes testing, limited higher-order thinking questions, and infrequent metacognition. The teaching paradigm is perpetuated

in the lecture-exclusive course design, where students are passive recipients rather than active participants. The teaching paradigm tends to be aligned with the surface approach to learning.

The *learning paradigm*, on the other hand, is the ideal in the eyes of constructivist-thinking educators. In the learning paradigm, the focus is less on what the teacher does, and more on the actions of the student. The learning paradigm frames learning in a holistic way that is less about covering content and more about how students will learn in the course. Biggs and Tang (2011) stress that the success of the learning paradigm is best achieved when a course or learning experience is constructively aligned, where learning outcomes, learning activities, and assessment methods work together. The learning experiences and assessment methods, "while not *necessarily* grounded in a constructivist foundation, are *consistent* with constructivist ideas, and are *favoured* by many constructivists" (Potter, 2013, p. 4).

The reason why these two paradigms are important is that they correlate quite neatly into the deep and surface approaches to learning. As outlined in Biggs' 3P Model of Teaching and Learning, what the student does is paramount in the learning process. Some of those decisions of the student are products of their own volition, while some others are superimposed on them via the paradigm being adopted in the undergraduate education context. An awareness of these paradigms is important to understand how the roles of instructors are influencing the actions of the students.

In Ontario, there is increasing interest in advancing and understanding teaching and learning on university campuses (COU, 2012). A recent report by the Council of Ontario Universities (COU) (2012) entitled *Beyond the Sage on the Stage* illustrates over

30 projects being undertaken at universities in Ontario, from faculty development programs to innovative assessment methods, to the incorporation of learning technologies. With 20 centres for teaching and learning (or some similarly-named offices) operating out of university institutions in Ontario, it is evident that there are people on nearly every university campus working to adapt the educational experience of students to promote deep learning instead of simply repeating the status quo set by ancient forms of higher education. While worthy endeavours in their day, traditional pedagogies do not suit current young adult students, who have vastly different backgrounds, lifestyles, and future ambitions.

The perceived teaching culture of a postsecondary institution indirectly affects students' approaches to learning in terms of motivation. While motivation is not a sole factor in the success of student learning, it has been shown to affect perceptions. In a multi-institutional study by Kustra et al. (2014), students at three universities in Ontario participated in research to design a survey instrument to measure teaching culture indicators. Their study asked participants to complete a version of the survey specific to their role (student or faculty member), and encouraged participation in follow-up focus groups. The content of the survey and the focus groups were a mix of questions about teaching culture indicators and instrument design questions. The results of the student participants were significant, as "students from all three institutions [reporting] commonly reported that professors' use of best teaching practices…such as group discussion, classroom participation, or problem-based learning…reflected value in teaching" (Kustra et al., 2014, p. 56). The findings of Kustra et al. (2014) affirmed that

teaching that employs methods consistent with constructivist thinking positively affects student perceptions of their learning environment.

In a separate study, Potter, Kustra, Ackerson and Prada (2015) investigated the experiences of faculty members who had recently completed a specialized faculty development program, the *University Teaching Certificate* (UTC). The UTC program "is intended to contribute toward the long-term goal of helping the University of Windsor develop a learning-centred teaching culture" (Potter et al., 2015, p. 4). Participants in the study completed a number of teaching inventories which became part of their summative program portfolio, and participated in focus groups. Through the research of Potter et al. (2015), it was found that faculty members who were exposed to a constructivist approach to teaching and learning were better equipped to design course syllabi, select teaching techniques, and ask feedback from their students. One participant identified that he '"never paid much attention to what my students thought or knew before they got it … [the students] were just blank to me and I would just tell them what I knew' – an approach to teaching to which, he said, he would never return" (Potter et al., 2015, p. 39). It is evident from these results that the UTC faculty development program is one positive way to promote the teaching paradigm, which in turn affects student approaches to learning in a positive way. The UTC program has also been identified by the COU (2012) as an example of innovative way to advance teaching and learning in Ontario.

In conclusion, my review of relevant literature surveyed the main aspects related to learning, student learning research, student approaches to learning, and the context of university teaching and learning. What follows in the next chapter is a detailed description of the research methods of this research project.

CHAPTER 3: RESEARCH METHODS

Research Design

My research study investigated the student approaches to learning (SALs) of a sample (*N*=60) of first-year and fourth-year undergraduate students studying in the Faculty of Science at the University of Windsor. The study involved a survey approach and mixed methods design.

A convergent parallel mixed methods design was used, which included the collection of both quantitative and qualitative data. In a convergent parallel design, both sets of data are collected and analyzed separately but simultaneously, and are then merged to provide results which are informed by both qualitative and quantitative datasets. For my study, an online survey was the method of data collection for both the qualitative and quantitative data sets. The survey was made up of three distinct parts. The Revised Two Factor Study Process Questionnaire (R-SPQ-2F) (Biggs, Kember, & Leung, 2001) served as the instrument to identify the approaches to learning of student participants, and collected quantitative data. A second section of the online survey included open-ended introspective questions, which explored the participants' conceptions of learning and perceptions of their learning environment. A final section comprised of demographic questions made up the remainder of the survey.

The reason I chose to collect both quantitative and qualitative data was because "researchers write for audiences that will accept their research" (Creswell, 2008, p. 19). I envisioned that my study would (a) help students understand their approaches to learning; (b) prompt instructors to assess their teaching; (c) aid educational developers in

instructional design; and (d) promote an understanding of some academic aspects of the student experience to administration.

The Convergent Parallel Design. The study utilized a mixed-methods convergent parallel design. The purpose of a convergent parallel design is to "bring together the differing strengths and non-overlapping weaknesses of quantitative methods (large sample size, trends, generalization) with those of qualitative methods (small sample, details, depth) … to develop a more complete understanding of a phenomenon" (Creswell & Plano Clark, 2011, p. 77). A graphical understanding of the convergent parallel research design is seen in Figure 3.

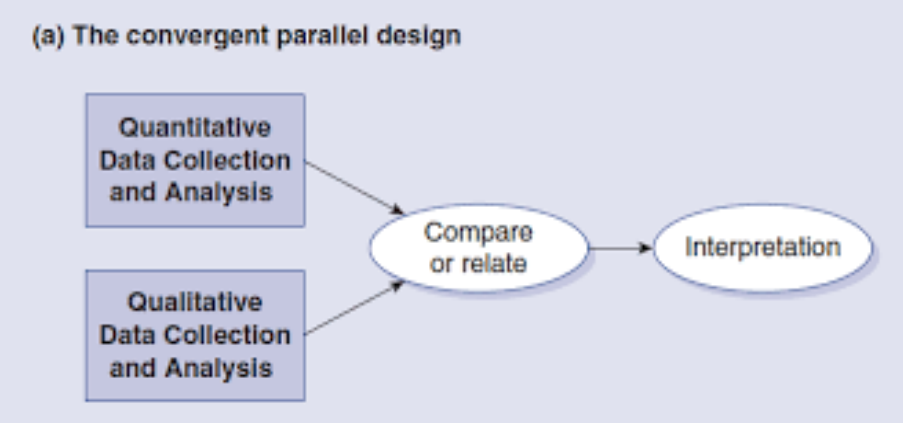


Figure 3. Convergent parallel research design. *Reprinted from Educational research: Planning, conduction, and evaluating quantitative and qualitative research* (4th ed.), by J. W. Creswell, 2012, p. 541. Copyright 2012 by Pearson Education, Inc. Reprinted with permission.

A convergent parallel design was best suited for the study because the quantitative student approach scores needed to be contextualized and clarified through the qualitative explanations of the participants themselves. This was especially necessary because the research questions of the study were informed by a constructivist theoretical framework. There is immense value in two data sets complementing each other to construct a solid

conclusion, because qualitative data "can augment and explain complex or contradictory survey responses" (Driscoll, Appiah-Yeboah, Salib, & Rupert, 2007, p. 24).

The convergent parallel design stands in contrast with the sequential explanatory design, which uses the quantitative data and results to inform the development of the qualitative method, in order to investigate a specific aspect revealed in the quantitative data (Creswell & Plano Clark, 2011). A sequential explanatory design may be suitable for a follow-up study, but since my study provided only an initial point of entry into the discussion of student approaches to learning at the University of Windsor, the results provided a benchmark rather than identified a specific anomaly.

In Figure 3, Creswell and Plano Clark (2011) depict a sample study with two separate methods of data collection. For the purposes of my research project, the online survey was the only method of data collection. While it could not collect as much narrative, the survey created a broader set of qualitative data than focus groups could provide. One data collection method also kept the study feasible for me to carry out as a student researcher. The two sets of data were still collected in separate sections of the survey, analysed separately, and only brought together to inform results.

Participants

|My research recruited participants from a purposive sample, "because of the unique characteristics of analysis" (Nardi, 2014, p. 124). A purposive sample suggests that the group of people chosen as participants have a specific trait that makes them suitable for the study (Creswell, 2012; Nardi, 2014). For this study, undergraduate students were selected from a specific institution and faculty so as to make the study feasible. To select a faculty, I consulted enrollment data from the Winter 2016 semester

published by the Office of Institutional Analysis at the University of Windsor. (University of Windsor Office of Institutional Analysis, 2016). I then compared demographics including gender, visa status, and enrollment status across faculties. Upon a review of the demographic data, students from the Faculty of Science were chosen for recruitment due to the size of the faculty and its unique program demographics.

Since my study was a cross-sectional study, data was only collected one time. Therefore, I needed to select a specific subset of students assess the influence of time spent in university as a significant factor of influence on a student's approach to learning. Participants were recruited from two different stages of progress in their undergraduate studies: first-year students (semester 1 or 2) and fourth-year students (semester 7 or 8). I selected these groups deliberately, to understand two unique groups of students, first-year undergraduates and fourth-year undergraduates, but also to assess if any correlations or comparisons could be drawn between students who had shared similar educational experiences in a similar teaching and learning culture.

Data Collection

Before data collection began, approval was obtained from the Research Ethics Board (REB) at the University of Windsor. Data collection for the study consisted of one instrument: an online survey (see Appendix A). The online survey was comprised of three sections: the first for the collection of quantitative data, the second for collection of qualitative data. In a convergent parallel design, "the researcher may embed one smaller form of data within another larger data collection in order to analyze different types of questions" (Creswell, 2008, p. 15). Applying an embedded strategy was possible due to the use of an online survey.

The quantitative section of the online survey was Biggs, Kember and Leung's Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) (2001). Utilizing the R-SPQ-2F allowed me to gather quantitative data in the form of deep and surface approach scores. By analyzing those data I will address the first research question (*Which approaches (deep or surface) are undergraduate students at this university identifying as their dominant approach?*). In the preceding chapter, I outlined the R-SPQ-2F survey from a theoretical perspective.

The second section of the online survey included open-ended questions and demographics. The qualitative dataset addressed sub-questions of my study (i.e., *what factors are contributing to the dominant approach to learning that students have identified?* and *from the student perspective, how might the identification of student approaches to learning be useful to inform university teaching, learning, and educational development?*). I discuss instrumentation in a subsequent section of this chapter.

Recruitment. Once approval for my study was granted by the REB, participants were recruited via email correspondence through the UWindsor MassMail service. The recruitment email (see Appendix C) included information about the study, the link to participate in the survey, researcher contact information, and the letter of consent (see Appendix B). The letter of consent was also displayed on the first screen of the survey. A reminder email (see Appendix D) was sent out one week after the initial recruitment email. These emails appeared as having been sent by me, eliminating a reliance on email forwarding from individual departments to students. Using the MassMail tool kept my contact with participants confidential, and kept participants unknown to me. The contact

information of those who received the email was never collected, nor were the identities of recipients who respond.

This research study was conducted during the final month of the academic year, in order for first-year students to have experienced the majority of their first year of undergraduate education before being asked to reflect on their practices. Additionally, timing the survey in this way supposed that fourth-year students had given more thought into their future plans including graduate studies, which was a piece of demographic information I collected because of its reported significance (Biggs et al., 2001).

Instrumentation. I constructed the survey using FluidSurveys, an online survey platform supplied by the University of Windsor. FluidSurveys was used to both build and host the survey used in my study. The survey had five pages: (a) welcome and consent information; (b) the R-SPQ-2F (quantitative); (c) approach score results and open-ended questions (qualitative); (d) demographics; and (e) summary and submission.

I chose to keep the quantitative and qualitative aspects of the survey separate from each other. I also organized the survey in a particular order, for a few reasons. Firstly, the R-SPQ-2F is a standalone instrument, and I did not want to modify a rigorously tested survey instrument unnecessarily. Secondly, the R-SPQ-2F includes an introduction to the research, which was a practical fit for my survey. Thirdly, I put the qualitative questions on the page after the quantitative questions because I wanted to provide participants with an opportunity to think about the qualitative questions by using the quantitative set of questions as a primer. Fourthly, I used a separate screen for the qualitative questions because I did not want to influence participants by having the quantitative questions visible. Lastly, I chose to collect demographic data at the end of the survey, as it has

been identified that demographic questions provide the survey respondent with an easier task at the end of the survey experience (Nardi, 2014).

Quantitative data. The main objective of the quantitative research phase of my research study was to identify the dominant learning approaches of the undergraduate students who participated in the project. The pre-designed survey instrument being incorporated into my research is the R-SPQ-2F created by Biggs et al. (2001) out of a redesign of Biggs' (1987) original Study Process Questionnaire (SPQ). The R-SPQ-2F instrument may be used by educators "for evaluating their teaching and for genuine research purposes . . . [acknowledging] the source . . . and [accepting] that the copyright on the questionnaire is owned by John Biggs and David Kember" (Biggs et al., 2001, p. 11). Proper acknowledgement of the R-SPQ-2F has been given throughout this document, as well as on the page of the online survey where the R-SPQ-2F is used.

As mentioned in the literature review, the R-SPQ-2F has been used to measure the approaches to learning from a variety of postsecondary student samples. The R-SPQ-2F instrument includes a set of 20 five-point Likert scale questions regarding studying techniques. The 20 items correlate into two subsets (hence the R-SPQ-2F's name) which correspond to the deep approach (questions 1, 2, 5, 6, 9, 10, 13, 14, 17, and 18) and the surface approach (questions 3, 4, 7, 8, 11, 12, 15, 16, 19, and 20). Within these two factors, two additional sets (subscales) are identified: deep motive and deep strategy, and surface motive and surface strategy. The subscales are less reliable, with some studies not validating them (Justicia et al, 2008; Socha & Sigler, 2014). Biggs et al. (2001) suggest that the two factors should be sufficient for the everyday purpose of the R-SPQ-2F as an identifier of student approaches to learning.

Qualitative data. Student learning research benefits from a qualitative component which explains the qualitative data collected. The objectives of the qualitative research phase were twofold: to collect data that could contextualize the quantitative data collected by the R-SPQ-2F, and to collect information on student perceptions about undergraduate teaching and learning. Based on previous research and the research questions of my study, three open-ended questions were created to collect student perceptions about undergraduate teaching and learning:

1) What **factors** might have influenced the approach to learning identified by your responses?
2) What does **learning** mean to you?
3) From your perspective **as a student**, how could the information from this study help make teaching and learning better at the university?

These three questions were meant to better understand the mindset of the participants beyond their responses to the R-SPQ-2F. By including them on the survey, I collected a wider variety of qualitative data than I would have using a second protocol (e.g., interviews, focus groups, etc.). The coding and analysis of qualitative data is explained in the following subsection of this chapter.

The R-SPQ-2F does not include any demographic questions. However, Biggs (1987) provided guidance about demographics in the original SPQ Research Monograph. I first consulted a number of studies that had used the R-SPQ-2F to identify some overlapping identified demographic factors (Biggs et al., 2001; Smith, 2005; Tural Dincer & Akdeniz, 2008; Wiese & Newton, 2013). Carrying out this review process led me to create similar demographic questions which allowed the sample to be dissected into

meaningful groups based on gender, age, year of study, program, enrollment status (part time or full time), domestic or international student status, and aspirations of graduate study. Ultimately, these questions linked directly to the research questions of my study, as they sought to explain patterns in the quantitative data collected based on standard student identities.

The implications of online research. The collection of quantitative data and qualitative data via the survey instrument took place simultaneously, as dictated by the convergent parallel research design my study adopted. A convergent parallel design was possible for me to undertake in large part to the administration of an *online* survey. Using the internet as a tool to conduct research has positive and negative implications. Psychology researchers (Kraut et al., 2004) identified a number of positive aspects of online psychology research, including a reduced cost to administer a survey, participant access, and automation and experimental control. They also acknowledged challenges, both new and perpetuated by online research, namely the loss of control of the research setting, notions of public and private behaviour, and questions of anonymity and confidentiality breaches leading to harm (Kraut et al., 2004). I made a significant attempt to control these challenges by incorporating safeguards and design features into the survey, but these are legitimate concerns that have no clear answers.

Originally a paper instrument, Biggs (1987) acknowledged that computer versions of the instrument are suitable ways to score the SPQ. The online survey had to be electronically recreated, and was deployed through FluidSurveys, a well-known online survey platform accessible to me as a graduate researcher which provides a stable, secure platform for online surveys. Using FluidSurveys allowed me to create question

branching and calculations not possible when using the paper version, including the automatic calculation and display of approach scores to the participant as well as tailored information about the dominant approach the participant's responses identified. Dynamic survey results added to the benefits of participation in the survey, as students could engage in a metacognitive activity of sorts. Where students are engaged in metacognitive skills, they achieve greater self-knowledge and task knowledge, and both are necessary for most forms of academic learning (Biggs, 1988).

The use of an online survey had many benefits for the participants, including accessibility and convenience. While the survey did require an internet connection, all participants were currently enrolled at an institution offering a secure wireless network connection to all while physically present on campus. Additionally, the survey could have been completed on mobile devices, including smartphones and tablets connected to the internet through data connections provided by telecommunications companies. While online surveys have been known to result in lower response rates than paper surveys (Kraut et al., 2004), some participants of the survey belonged to a demographic which is increasingly relying on digital technologies as a means to communicate and learn (Prensky, 2001). The recruitment email included a clickable hyperlink, which further simplified the process to complete the survey.

Data Analysis

When using the convergent parallel design, the researcher treats the qualitative and quantitative sets of data as separate throughout both the collection and the analysis. As a result, the two sections of the survey were analyzed separately to allow me to "[use] the best features of both quantitative and qualitative data collection" (Creswell, 2012, p.

542). Within a convergent parallel research design, both sets of data should be treated as equally important (Creswell & Plano Clark, 2011). In conducting this study, I adhered to this fundamental guideline, as both sets of data were of significant importance due to a lack of research into student approaches to learning at the University of Windsor.

Quantitative data analysis. The data collected from the R-SPQ-2F was organized using the export tools embedded within the FluidSurveys platform. I exported the data from FluidSurveys in two formats: a spreadsheet file which I used mostly for qualitative data, and an SPSS file, which I used for all statistical calculations and for comparing the two datasets. No personal information was collected beyond the responses to the demographic questions.

The quantitative data was analyzed using descriptive and inferential statistics. Mean values and percentages for deep approach and surface approach were calculated for all demographic groups. I then identified trends and correlations in the data, trying to understand the story the numbers were telling. The approach scores identified the dominant approach to learning of each participant and provided insight into how the participants were perceiving their learning environment. If a classroom teacher were conducting similar research for their individual development as an instructor, this point might be the extent to which they investigate. As for my project, however, this was the jumping off point.

In order to identify if the R-SPQ-2F's two factor structure was suitable, factor analysis was employed (Jöreskog, 1969). While commonly followed heuristics suggest that samples be in the hundreds of participants when performing factor analysis (e.g. Cattell, 1978; Comrey, 1973), there has been efforts to understand the relationships

between sample size, high communalities, and the per factor ratio (Gagné & Hancock, 2006; Jackson, 2001). In simulations performed by de Winter, Dodou, and Wieringa (2009), it was found that factor analysis could provide acceptable results for samples well below 50. Given the problem structure of two dimensions and 20 questions coupled with the observed factor loadings and high communalities, the sample in this study (N=60) was not a concern.

It was necessary to test the two-factor structure of the R-SPQ-2F given that the participants of my study were different students than those in Biggs, Kember and Leung's original sample. Factor analysis has been done in previous studies when using the R-SPQ-2F in new contexts (Acai & Newton, 2015; Kirby et al., 2008). Richardson (2000) astutely describes factor analysis as:

> A technique for identifying the constructs (usually called 'factors' or 'components') that seem to underlie a set of quantitative data. If several variables are all very highly correlated with one another then it is reasonable to assume that they are all tapping the same underlying construct. For example, if a lot of people were asked which hand they prefer to use for writing, for throwing, for cutting with a pair of scissors, and so on, their responses prove to be highly associated with one another (that is, most people – although not all – will report using the same hand for most of these activities). This then makes it sensible to talk about a single underlying dimension that might be called 'handedness'. In other cases, however, the pattern of correlations will imply the existence of two or more underlying constructs…it may then be necessary to transform (or 'rotate') these factors to achieve the most meaningful. (p. 62-63)

Internal consistency was also measured by calculating the Cronbach alpha coefficients for the deep and surface approach scales using the results of the R-SPQ-2F (Cronbach, 1951). Using SPSS, I then calculated one-way and two-way ANOVAs (analysis of variance) to understand the effect the demographic categories had on the approach scores.

Qualitative data analysis. The first task associated with my analysis of the qualitative research was to "trust the process and to have faith that there [would be] important themes in [my] data and that [I would] have the insight and skill to find them and tie them together in meaningful ways" (van den Hoonaard, 2012, p. 114). As a graduate student undertaking my first large research project, there was a sense of uncertainty around the qualitative data analysis, since it was something new for me.

The qualitative data from the open-ended survey questions were compiled using the FluidSurveys exporting tools. The data were already in an electronic format since participants typed their responses. This would not have been the case if the survey was handwritten, or if interview or focus group protocols were used. Unlike the quantitative dataset, which needed to be complete before data analysis, I was able to begin the analysis of the qualitative data as individual responses were submitted.

Coding. In my study, an "existing theory or prior research exists about [the] phenomenon that is incomplete or would benefit from further description" (Hsieh & Shannon, 2005, p. 1281). This led me to employ a directed approach to content analysis. Open coding is the first phase of coding where the researcher is focused developing a number of initial concepts that describe what the participant is actually trying to say (Creswell, 2012). I hand-coded the participants' responses by printing them and writing on the transcript. First, I read each response, and highlighted key words that stood out

from the participants' responses. I continued open coding, making notes on the printed copies of the participant responses. After all responses had been coded, I began focused coding, and grouping the responses together. For the first and third questions (i.e., *what **factors** might have influenced the approach to learning identified by your responses* and *from your perspective **as a student**, how could the information from this research help make teaching and learning better at the university?*), I categorized responses into the codes that emerged.

Data transformation. Data transformation is a process whereby a researcher changes qualitative data into a quantitative form for the purposes of analysis (van den Hoonaard, 2012). For the second qualitative survey question (*what does **learning** mean to you?*), I identified codes from key words, then grouped the responses by the seven conceptions of learning I have identified in my literature review. I did not confine responses to those categories alone, however, as I sought to "understand the participant's situation from his or her point of view" (van den Hoonaard, 2012, p. 121). I then quantified the participants' responses by simply tallying them by assigning a value of 1 in SPSS if the response matched the participant's dominant approach to learning. It did turn out that all participants' responses fell into the categories.

I have explicitly outlined these procedures, because a transparency is a trait lacking in educational leadership research, and I suspect by extension in student learning research (Brooks & Normone, 2015).

Ethical Considerations

My research took place only after approval from the University of Windsor Research Ethics Board (REB). The recruitment and data collection methods I have used

were designed to protect the identity and confidentiality of participants in the study. The inclusion criteria were only as specific as needed for the study, and did not exclude students for reasons other than to investigate the research questions. Participants were free to participate to the extent they felt comfortable, which meant they could exit the survey at any time without penalty. Participants could choose to complete any one or all of the questions. Incomplete survey responses were assessed on a case-by-case basis. While all 60 participants completed the quantitative portion of the survey, only 52 (86.7%) chose to complete the open-ended questions. Interestingly enough, those who skipped the open-ended questions still completed the final demographics section.

Voluntary participation. Participation in the research was completely voluntary. Participants voluntarily decided to participate in the research by clicking the link to the survey in the recruitment email (see Appendix C). A letter of consent was included at the beginning of the online survey, and participants gave their consent by checking a box and clicking to continue. Participants received the same letter and instructions in the recruitment email.

Participants were also informed of their rights to withdraw in the information letters and the introduction to the online survey. Participants who actively withdrew (i.e., do not simply 'close' out of the browser, but select a button that cancels participation), had their responses automatically removed from the dataset. Those who simply closed the browser window had their responses flagged, and at the conclusion of the study I removed these survey attempts, none of which contained any responses. After completion and submission of the survey, participants were not able to withdraw their

data. The survey contained no identifying marks or codes, which meant that I had no way to remove a specific participant's data after submission.

As a researcher, I was in no position of authority or power over the participants. I had no prior relationships with any potential participants, and could in no way influence them. The participants in my research were not being coerced or forced to participate in any way, nor was there any compensation for participants. The research tools were non-invasive and the research methods did not affect any formal assessment of the participants as students. The research did not have grades attached, so there was no academic impact, nor any impact on the participants' status as students at the institution.

Risk, anonymity and confidentiality. In response to TCPS 2 guidelines (CIHR, NSERC, & SSHRC, 2014), all participants in my study were guaranteed confidentiality. All data collected was treated as confidential information. During the online survey, participants were reminded to refrain from submitting any information which might identify them as an individual. In turn, survey results were anonymous, creating a low-risk situation. Even if the data had been seen by another person other than myself, there would be no way to attribute a set of responses to any one person. The possibility of such an information leak was minimized by a detailed plan to safeguard the collected data. All textual data was securely stored in a password-protected file folder on my password-protected desktop computer. The data collected using FluidSurveys was deleted from the FluidSurveys account at the end of my research project. Again, while the security procedure might seem overly detailed, I designed these safeguards to minimize risk toward participants. I would expect that other researchers would safeguard any data I would provide them as a participant.

Benefits of my research. Within the constructivist conception of learning, students make meaning by their experiences. As a researcher and an educator, I feel that the experience of participating in the study should be a learning experience which affects positive change in the life of the participant. At the midpoint of the online survey, participants were informed of their results of the R-SPQ-2F in the form of a set of numbers. They also received a short paragraph describing the approach to learning that was dominant from the answers they provided. The custom learning approach information could have been printed as a part of the participant's survey summary. During the survey, participants were able to reflect on their study processes, and how those comprised the dominant learning approach identified by their responses. Participants might have become more self-aware, and learned more about the process of learning they are going through during their undergraduate study. They also added to the collective dialogue around teaching and learning culture on their campus. Their voices, as students, needed to be heard as they are a valuable source of feedback and data, especially for the critically reflective educator (Potter, 2013).

Indirectly, my research could benefit those who do not participate. My research added to the body of research about student learning, and initiated conversations about teaching and learning that otherwise might not happen. Identifying student approaches to learning can be useful to instructors to assess their teaching, to educational developers to engage in instructional design, and to administration to help understand and quantify academic aspects of the student experience. In short, the research benefitted students directly (see above), and also indirectly by helping others in the academic community provide teaching and learning experiences that are most beneficial to students. Any

person who was interested in my research was able to attend my M.Ed. defense, promoting knowledge mobilization. Any person with interest can also access the full report of my research – my M.Ed. thesis – online from the UWindsor Electronic Thesis Database.

CHAPTER 4: RESULTS

In this chapter, I present the data collected and analyses of the data in my research study. The data included in this chapter were collected and analysed to understand students' perceptions of their undergraduate learning environment as evidenced by the approach to learning they identified, demographic information, and answers to the open-ended questions asked in the survey. The first section of the chapter addresses the quantitative aspects of the questionnaire, namely, student approaches to learning and demographics. The second section delves into the qualitative components of the survey, which include participants' personal definitions of learning, identified self-awareness of factors affecting their learning, and the potential uses for the research results, from the student perspective.

As mentioned previously, the data collected from this research project included both quantitative and qualitative sets. Both were collected using the same online survey, but, as guided by a convergent parallel design, the two datasets were analyzed independently. They have been brought together in the second part of this chapter, and I discuss their convergence in greater detail in the following chapter.

Quantitative Data Analysis

The quantitative data collected from this research were collected in two sections of the online survey: (a) the Revised Two-Factor Study Process Questionnaire (R-SPQ-2F); and (b) the demographic questions. This data was collected to answer the main research question: *Which approaches to learning are science students at the University of Windsor identifying as their dominant approach?*

The online survey was designed to collect data from participants who were first-year and fourth-year undergraduate students studying in the Faculty of Science at the University of Windsor. Six departments from the Faculty of Science are represented in the sample: Biology, Chemistry and Biochemistry, Computer Science, Earth and Environmental Sciences, Mathematics and Statistics, and Physics. The Department of Economics was not represented in the sample due to a lack of responses from its students. Data collection yielded a survey response rate of 8.52%, with a survey completion rate of 85.7% (N=60).

Descriptive statistics and demographics. The first analysis of the quantitative data was descriptive in nature, outlining the student approaches to learning of the participants categorized by the demographic data. To calculate deep approach and surface approach scores for each participant, I used the scoring rubric provided with the R-SPQ-2F. Individual approach scores were calculated using participants' responses from the 5-point scale questions on the R-SPQ-2F, tabulated using the scoring rubric on the original copy of the R-SPQ-2F (Biggs et al., 2001). These calculations were completed in real-time, as I programmed them into the FluidSurveys platform. Deep approach scores were calculated by adding the scores of questions 1, 2, 5, 6, 9, 10, 13, 14, 17, and 18, while surface approach scores were calculated by adding the other set of questions: 3, 4, 7, 8, 11, 12, 15, 16, 19, and 20.

Table 5

Participant Demographic Overview

Variable	Category	*n*	%		
			Sample	Cumulative	*Population*
Gender	Male	35	58.3	58.3	*58.5*
	Female	25	41.7	100.0	*41.5*
Year	First-Year	30	50.0	50.0	*46.4*
	Fourth-Year	30	50.0	100.0	*53.6*
Age	17-18	24	40.0	40.0	.
	19-20	6	10.0	50.0	.
	21-22	21	35.0	85.0	.
	23-24	7	11.7	96.3	.
	25+	2	3.3	100.0	.
Program	Biology	21	35.0	35.0	*39.3*
	Chemistry & Biochemistry	13	21.7	56.7	*25.7*
	Computer Science	13	21.7	78.4	*22.8*
	Earth & Environmental	3	5.0	83.4	*3.3*
	General Science	1	1.6	85.0	.
	Math & Statistics	6	10.0	95.0	*3.1*
	Physics	3	5.0	100.0	*5.8*
Enrollment*	Full-time	58	96.7	96.7	*85.0*
	Part-time	2	3.3	100.0	*15.0*
Status*	Canadian	58	96.7	96.7	*91.8*
	International	2	3.3	100.0	*8.2*

Note: *Not used for statistical calculations due to lack of diversity in sample.

Demographics. The demographic makeup of the participants is shown in Table 5. The sample was comprised of 60 participants (*N*=60) who voluntarily completed the online questionnaire from the link in the recruitment emails. Participants identified as male (*n*=35, 58.3%) and female (*n*=25, 41.7%). Participants evenly represented first-year students and fourth-year students at 30 participants each. The age of participants was recorded in ranges of two years, with 24 participants being 17 or 18 years old (40%), 6 participants aged 19-20 years old (10%), 21 participants 21 of 22 years old (35%), 7

participants aged 23 or 24 years old (11.7%), and 2 participants aged 25 years or older (3.3).

Participants represented six of the seven departments within the Faculty of Science at the University of Windsor: 21 from Biology (35.0%), 13 from Chemistry and Biochemistry (21.7%), 13 from Computer Science (21.7%), 3 from Earth and Environmental Science (5.0%), 6 from Math and Statistics (10.0%), 3 from Physics (5.0%), and 1 who identified as "General Science". The department of Economics was not represented in this study, due to a lack of participants. Participants included 58 full-time students (96.7%) and 2 part-time students (3.3%), and 58 of them identified themselves as Canadian or domestic students (96.7%), while only 2 identified as international students (3.3%).

Table 5 includes the population percentage, as calculated using enrollment statistics. The sample is representative of the population of science students when compared to University of Windsor enrollment data, with the exception of the "Enrollment" and "Citizenship" categories. Reasons for this are unknown, as all students were recruited in the same way. As a result, statistical analyses cannot take into account the differences of full-time or part-time enrollment, nor Canadian or international student status. This means that the unique challenges of two minority groups, part-time students and international students, cannot be accurately understood from this research. Part-time implies a different time commitment to undergraduate study, likely affecting the approach to learning these students take. Similarly, international students have unique educational experiences that undoubtedly differ from Canadian students. These groups of

students are worth investigating, perhaps in a replication study that specifically looks at those differences.

Table 6

Participants' Aspirations of Graduate Study

Variable	Category	Applied or Accepted	Considering	Unsure	No
All Students		**5**	**22**	**22**	**11**
Gender	Male	3	17	10	5
	Female	2	5	12	6
Year	First-Year	0	5	16	9
	Fourth-Year	5	17	6	2
Age	17-18	0	4	14	6
	19-20	0	1	1	4
	21-22	4	11	5	1
	23-24	1	5	1	0
	25+	0	1	1	0
Program	Biology	2	10	4	5
	Chemistry & Biochemistry	3	2	6	2
	Computer Science	0	5	7	1
	Earth & Environmental	0	3	0	0
	General Science	0	0	1	3
	Math	1	1	2	0
	Physics	1	1	2	0
Enrollment*	Full-time	5	21	21	11
	Part-time	0	1	1	0
Status*	Canadian	5	22	20	11
	International	0	0	2	0

Note: *Not used for statistical calculations due to lack of diversity in sample.

Two other questions were asked on the demographics page, asking participants to provide information about themselves which is specific to the context of this study. Table 6 identifies participants' responses to the question, *which statement best describes your current interest in graduate studies (e.g., Master's degree)?* From the responses of participants, there are noticeable differences between first-year and fourth-year student responses, as 22 of 33 students identified that they have "applied or accepted" or are "considering" graduate studies (66.7%), as opposed to only 5 first-year students (16.7%).

Similar polarizing trends can be seen in the responses to this question when broken down by age range.

The final demographic question asked participants, *before this survey, had you ever heard of a Student Approach to Learning (SAL)?* Only one participant identified that they had heard of a student approach to learning (1.6%), while 43 (71.7%) were unsure and 16 (26.7%) stated that they had not. As there is no indicator describing any difference between uncertainty and no, this question was not used in any further analysis.

Learning approach scores. Once demographic information had been established, deep and surface approach scores could be manipulated in meaningful ways. The data were exported from Fluidsurveys to SPSS, where statistical analysis could be undertaken in an efficient manner.

The survey created using Fluidsurveys did some rudimentary calculations with the data as they were being collected. First, deep and surface approach scores were automatically calculated within the survey in real-time. This was done to provide research participants with immediate results, in the hopes of fostering some sort of metacognition. The deep and surface approach scores, as well as the deep and surface motive and strategy scores were all part of the original data file exported from Fluidsurveys to SPSS. Participants' responses to individual questions were also preserved.

The next step was to calculate the mean deep and surface approach scores for each demographic group. This is illustrated in Table 7. The range of deep and surface approach scores is also included.

Table 7

Overview of Deep and Surface Approach Scores

Variable	Category	*n*	Deep Approach		Surface Approach	
			Mean	Range	*Mean*	Range
All Students		**60**	**29.38**	**17-45**	**28.48**	**13-44**
Gender	Male	35	30.49	18-45	28.71	15-44
	Female	25	27.84	17-43	28.16	13-43
Year of Study	First-Year	30	25.40	17-38	31.93	13-44
	Fourth-Year	30	33.37	22-45	25.03	15-38
Age	17-18	24	26.17	18-38	32.63	13-44
	19-20	6	20.50	17-28	30.00	20-43
	21-22	21	34.71	24-45	25.76	17-38
	23-24	7	30.86	24-42	23.29	17-28
	25+	2	33.50	30-37	21.00	15-27
Program	Biology	21	30.29	17-45	29.48	20-43
	Chemistry & Biochemistry	13	25.23	22-32	28.62	17-39
	Computer Science	13	28.85	18-39	27.46	13-44
	Earth & Environmental	3	39.33	37-42	24.33	18-28
	General Science	1	33.00	33-33	26.00	26-26
	Math & Statistics	6	30.00	17-39	30.83	17-42
	Physics	3	31.00	26-35	25.67	18-30
Graduate Aspirations	Applied or Accepted	5	31.00	24-43	25.20	22-28
	Considering	22	34.32	21-45	24.82	17-38
	Unsure	22	27.64	18-39	29.41	13-44
	None	11	22.27	17-29	35.45	21-43

Table 7 outlines mean approach scores calculated for individual variables. Male participants' mean deep approach score (M=30.49) was higher than the mean deep approach score of female participants (M=27.84), despite the surface approach means being practically equal (male, M= 28.71; female, M= 28.16). There is a noticeable difference between the first-year students' mean deep (M=25.40) and surface (M=31.93) scores compared to the fourth-year deep (M=33.37) and surface (M=25.03) mean scores. These scores are close to the mean age scores, primarily because those in first-year are

predominantly 17- and 18-year-old students, while fourth-year students come from the "21-22", "23-24", and "25+" age ranges.

Departmental means fluctuate depending upon the number and demographic makeup of respondents. When looking at participants by their self-identified aspirations for graduate study, the groups of students who have "applied or accepted" (*M*=31.00) or are "considering" (*M*=34.32) have noticeably higher deep approach scores than those who are "unsure" (*M*=27.64) or whose graduate aspirations are "none" (*M*=22.27). The trend appears to be reversed when looking at the surface approach based upon graduate aspirations, with the lowest mean surface approach scores belonging to the "considering" (*M*=24.82) and "applied or accepted" (*M*=25.20) groups, while higher mean surface approach scores are seen in the "unsure" (*M*=29.41) and the "none" (*M*=35.45). These emerging relationships and trends form the basis for statistical analysis. Please see Appendices F and G for a more detailed breakdown of deep and surface approach scores cross-tabulated by demographic factors.

With an understanding of the mean deep and surface approach scores as calculated by demographic group, I then started to look at which approach was dominant for each participant. To do this, a flag variable was calculated in SPSS whereby the surface approach score of each participant was subtracted from their deep approach score. Any values calculated to be 0 or less assigned the participant the qualifier "surface", and any values calculated to be above 0 assigned the participant the qualifier "deep". The raw difference of the two approach scores was also recorded for each participant.

Table 8

Overview of Dominant Learning Approach Scores

Variable	Category	Deep Approach			Surface Approach		
		n	*Mean*	%	*n*	*Mean*	%
All Students		**33**	**34.37**	**55.00**	**27**	**34.36**	**45.00**
Gender	Male	21	34.38	60.00	14	36.14	40.00
	Female	12	34.33	48.00	13	32.46	52.00
Year of Study	First-Year	10	30.60	33.33	20	36.40	66.67
	Fourth-Year	23	36.00	76.67	7	28.57	23.33
Age	17-18	8	30.68	33.33	16	37.44	66.67
	19-20	1	28.00	16.67	5	32.00	83.33
	21-22	18	36.22	85.71	3	30.33	14.29
	23-24	4	35.50	57.14	3	26.00	42.86
	25+	2	33.50	100.0	0	0	0
Program	Biology	12	36.58	57.14	9	36.78	42.86
	Chemistry & Biochemistry	3	27.33	23.08	10	30.10	76.92
	Computer Science	9	32.00	69.23	4	37.00	30.77
	Earth & Environmental	3	39.33	100.0	0	0	0
	General Science	1	33.00	100.0	0	0	0
	Math & Statistics	3	35.67	50.00	3	39.67	50.00
	Physics	2	33.50	66.67	1	29.00	33.33
Graduate Aspirations	Applied or Accepted	3	35.67	60.00	2	26.50	40.00
	Considering	19	35.79	86.36	3	32.67	13.64
	Unsure	11	31.55	50.00	11	35.18	50.00
	None	0	0	0	11	35.45	100.0

Note: Mean scores calculated using dominant scores only.

Table 8 presents participants' dominant approach score, segregated by demographic components. Mean scores for each approach in this table were calculated using only the participant scores for students who were identified as belonging dominantly to that approach. Overall, 33 students (55.0%) identified a deep approach as their dominant approach to learning, and 27 students (45.0%) identified a surface approach as dominant. When comparing gender differences, 21 of 35 male students (60.0%) identified a dominant deep approach, while only 12 of 25 female students

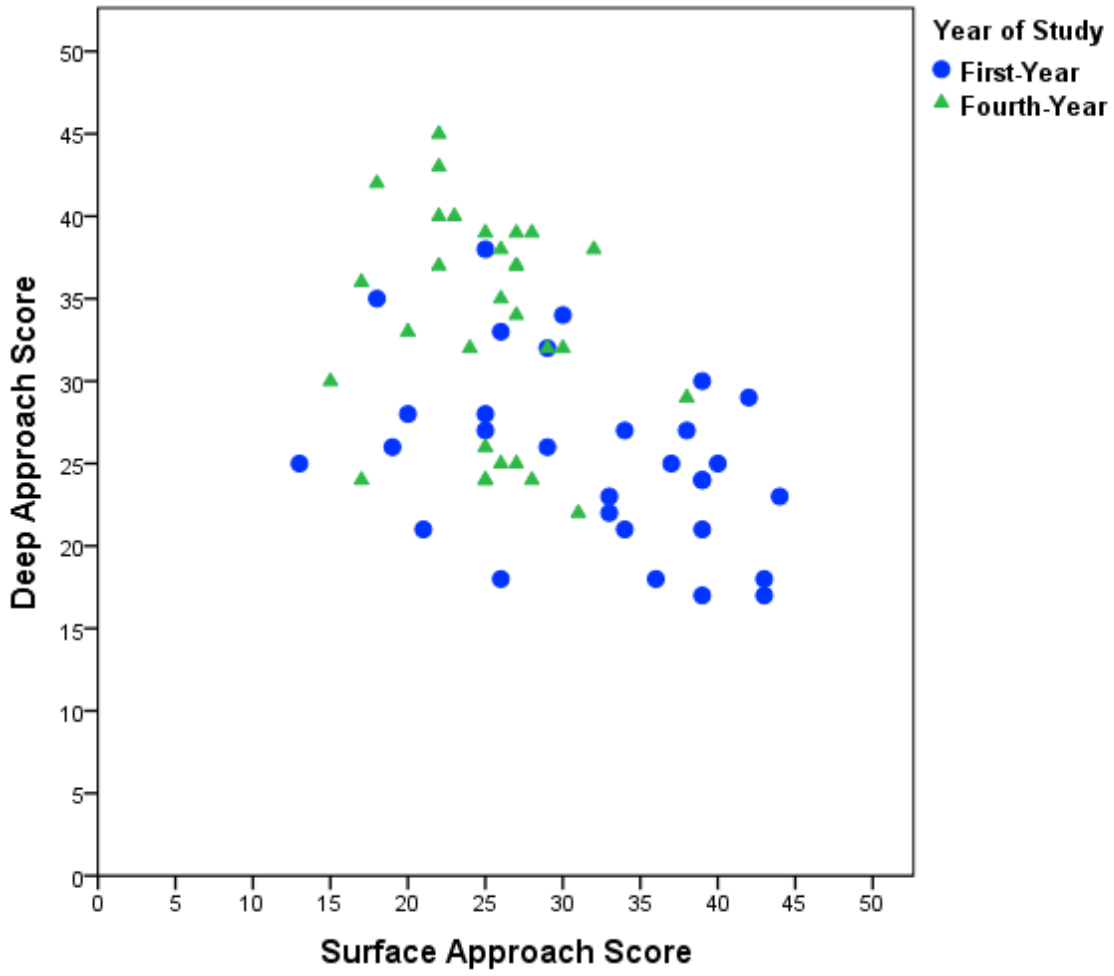
(48.0%). A majority of first-year students (66.7%) identified a dominant surface approach, while the opposite is true for fourth-year students, where 23 (76.7%) identified a deep approach as dominant.

Perhaps the most notable result is the groupings of dominant scores by graduate aspirations. Of those who identified a deep approach as dominant, two-thirds (66.7%) of them identified that they were considering, had applied, or had been accepted into a graduate program. Interestingly enough, all 11 (100.0%) participants who professed their aspirations of graduate study as "none" were assigned a dominant surface score. This seems logical, as those who take surface approach would likely not receive the same satisfaction that those who take a deep approach to their learning by continuing on to graduate study.

Figure 4 is a graphic representation of the approach scores of all participants plotted and designated by year of study. Note that the fourth-year participant data points (green triangles) smear up and to the left denoting dominant deep approach scores, while the first-year participant data points (blue circles) smear down and to the right, denoting surface approach dominant scores. The groupings show the differences between the first-year and fourth-year student approaches to learning from this study. The closer the data point is to the center, the less the difference between the deep and surface scores. While deep and surface approaches aren't categorized on a spectrum, it can be inferred that the larger the difference between the two scores, the more prominent the traits of the dominant approach would be.

Figure 4

Individual Student Approach Scores



Instrument Validity and Reliability

I tested the R-SPQ-2F for validity and reliability before making any additional claims about the data. Essentially, I wanted to know if the instrument was valid (i.e., it measured what I intended it to measure), and that there was internal consistency (i.e. the questions associated with the two approaches were properly grouped). I used a principal factor analysis and determined that the two factor structure was indeed acceptable. Two factors had outlying Eigenvalues (7.224 and 3.142), and they corresponded to the two

data points on the scree plot that were above the 'elbow break' (the point on the scree plot where the plotted Eigenvalues change direction and level out horizontally). I used a principal components analysis to analyze the factor structure of the R-SPQ-2F. The Eigenvalues suggested that the first two factors explained 36% and 16% of the variance respectively. Despite there being two other Eigenvalues slightly above the typical cutoff of 1.0, I opted to use the two factor structure. I did so for four reasons: (a) the two-factor structure of the R-SPQ-2F has a theoretical basis, (b) the two factor structure has been tested by others and found to be sufficient (Immekus & Imbrie, 2010; Justicia et al., 2008), (c) only two data points were above the elbow break on the scree plot of Eigenvalues, and (d) that with two factors, each question corresponded to only one factor at a factor loading of greater than 0.2, creating identical sets of questions as those associated with the deep and surface approaches, respectively. Table 4.6 provides the results of the exploratory factor analysis testing the two factor structure of the Revised Study Process Questionnaire.

Table 9

Factor Loadings and Communalities Based on a Principal Factor Analysis with Varimax Rotation for the Revised Two-Factor Study Process Questionnaire (N = 60)

Question	Approach	Factor 1	Factor 2	Communality
1. I find that at times studying gives me a feeling of deep personal satisfaction.	*Deep*	.60		.54
2. I find that I have to do enough work on a topic so that I can form my own conclusions before I am satisfied.	*Deep*	.51		.59
3. My aim is to pass the course while doing as little work as possible.	*Surface*		.68	.71
4. I only study seriously what's given out in class or in the course outlines.	*Surface*		.30	.56
5. I feel that virtually any topic can be highly interesting once I get into it.	*Deep*	.57		.60
6. I find most new topics interesting and often spend extra time trying to obtain more information about them.	*Deep*	.52		.61
7. I do not find my course very interesting so I keep my work to the minimum.	*Surface*		.39	.72
8. I learn some things by rote, going over and over them until I know them by heart even if I do not understand them.	*Surface*		.75	.66
9. I find that studying academic topics can at times be as exciting as a good novel or movie.	*Deep*	.61		.58
10. I test myself on important topics until I understand them completely.	*Deep*	.48		.46
11. I find I can get by in most assessments by memorizing key sections rather than trying to understand them.	*Surface*		.70	.65
12. I generally restrict my study to what is specifically set as I think it is unnecessary to do anything extra.	*Surface*		.47	.54
13. I work hard at my studies because I find the material interesting.	*Deep*	.72		.77
14. I spend a lot of my free time finding out more about interesting topics which have been discussed in different classes.	*Deep*	.73		.76
15. I find it is not helpful to study topics in depth. It confuses and wastes time, when all you need is a passing acquaintance with topics.	*Surface*		.68	.64
16. I believe that lecturers shouldn't expect students to spend significant amounts of time	*Surface*		.46	.51
17. I come to most classes with questions in mind that I want answering.	*Deep*	.84		.78
18. I make a point of looking at most of the suggested readings that go with the lectures.	*Deep*	.61		.60
19. I see no point in learning material which is not likely to be in the examination.	*Surface*		.67	.61
20. I find the best way to pass examinations is to try to remember answers to likely questions.	*Surface*		.75	.74

Note: Factor loadings < 0.2 are suppressed.

Biggs et al. (2011) identify that the two-factor structure of the R-SPQ-2F is the most practical, especially for the individual instructor. For the purposes of my research, the labels deep and surface were more than sufficient, and were retained. Internal consistency was measured for the two scales, by way of Cronbach's alpha. The alphas for both were good: .87 (95% CI = .81-.91) for Factor 1 (the 10 items aligned with the deep approach) and .87 (95% CI = .81-.91) for Factor 2 (the 10 items aligned with the surface approach). Alpha values were originally reported as 0.73 for deep approach and 0.64 for the surface approach (Biggs et al., 2001). It is important to note that the alpha values from my study are slightly higher than the alpha values identified by Biggs et al. (2001). They are also consistent with the findings of others (e.g., Clinton, 2014; Immekus & Imbrie, 2010; Socha & Sigler, 2014) who have obtained higher alpha values than those of Biggs et al. (2001), largely due to differing samples. Good alpha values suggest that the decision to use the R-SPQ-2F for this research was ultimately a good one.

One-way ANOVAs. A series of ANOVAs were computed to examine the relationships between the independent variables found in the demographic data and the dependent variables of deep approach score and surface approach score. It was my initial intention to explore the relationship between all demographic questions on approach scores, however this was not possible due to the lack of a representative sampling from international student and part-time student populations.

Gender and student approaches to learning. A one-way ANOVA was conducted to compare the effect of a student's gender on their deep approach score. The effect of gender on the deep approach score was not statistically significant within the

scope and sample size of this study, $F(1, 59)=1.966$, $p<0.05$, where $p=.166$. Additionally, a one-way ANOVA was conducted to compare the effect of a student's gender on their surface approach scores. The effect of gender on the surface approach score was also not statistically significant within the scope and sample size of this study, $F(1, 59)=.074$, $p<0.05$, where $p=.786$.

Age of student and student approaches to learning. A one-way ANOVA was conducted to compare the effect of the age of a student on their deep approach score. The effect of the age of a student on their deep approach score was statistically significant within the scope and sample size of this study, $F(4, 56)=10.768$, $p<0.05$, where $p<.001$. Additionally, a one-way ANOVA was conducted to compare the effect of the age of a student on their surface approach score. The effect of the age of a student on their surface approach score was also statistically significant within the scope and sample size of this study, $F(4, 56)=4.621$, $p<0.05$, where $p=.003$.

Figure 5

Mean Approach Scores in Relation to Student Age

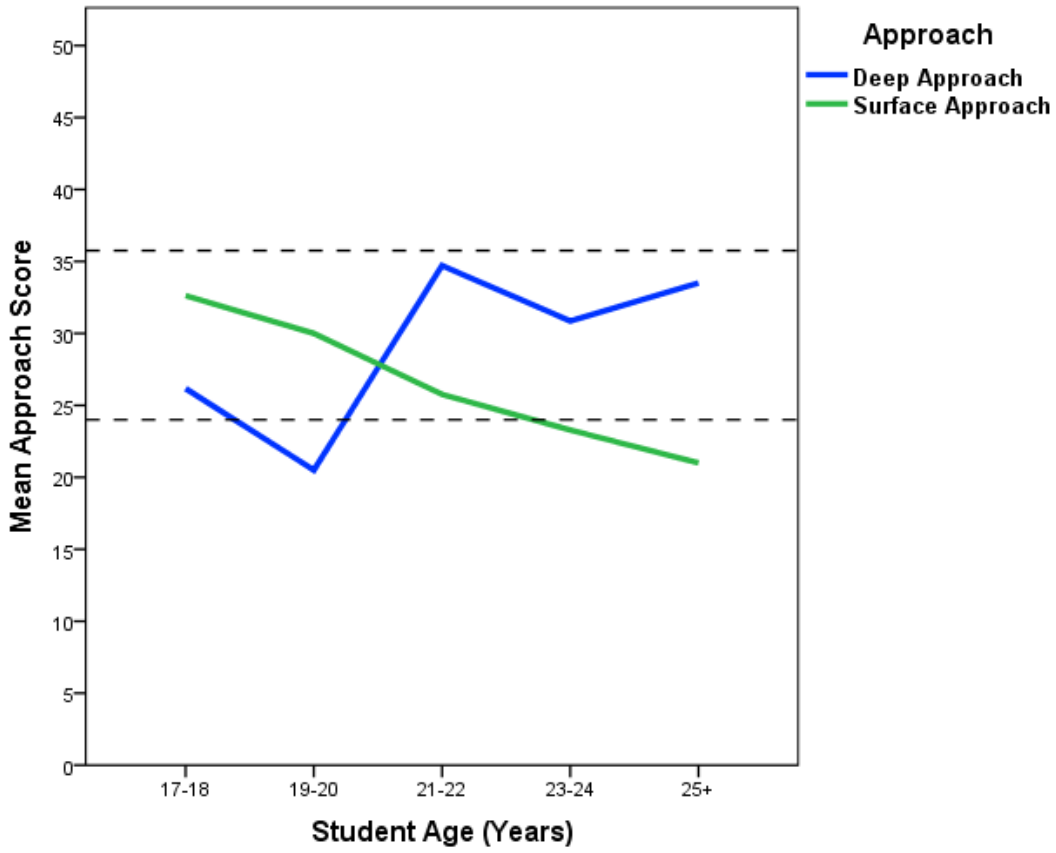


Figure 5 illustrates the positive trend between the independent variable of age, as seen in the five age demographic categories (17-18, 19-20, 21-22, 23-24, and 25+), and the dependent variable of deep approach score. As can be seen from the graph, the older student, the higher the deep approach score. Figure 5 also illustrates the negative trend between the independent variable of age, as seen in the five age demographic categories (17-18, 19-20, 21-22, 23-24, and 25+), and the dependent variable of surface approach score. As can be seen from the graph, the older student, the lower the surface approach score.

Year of study and student approaches to learning. A one-way ANOVA was conducted to compare the effect of a student's year of study on their deep approach score. The effect of a student's year of study on their deep approach score was statistically significant within the scope and sample size of this study, $F(1, 59)=25.538$, $p<0.05$, where $p<.001$. Additionally, a one-way ANOVA was conducted to compare the effect of a student's year of study on their surface approach score. The effect of a student's year of study on their surface approach score was also statistically significant within the scope and sample size of this study, $F(1, 59)=14.831$, $p<0.05$, where $p<.001$.

Figure 6

Mean Approach Scores in Relation to Year of Study

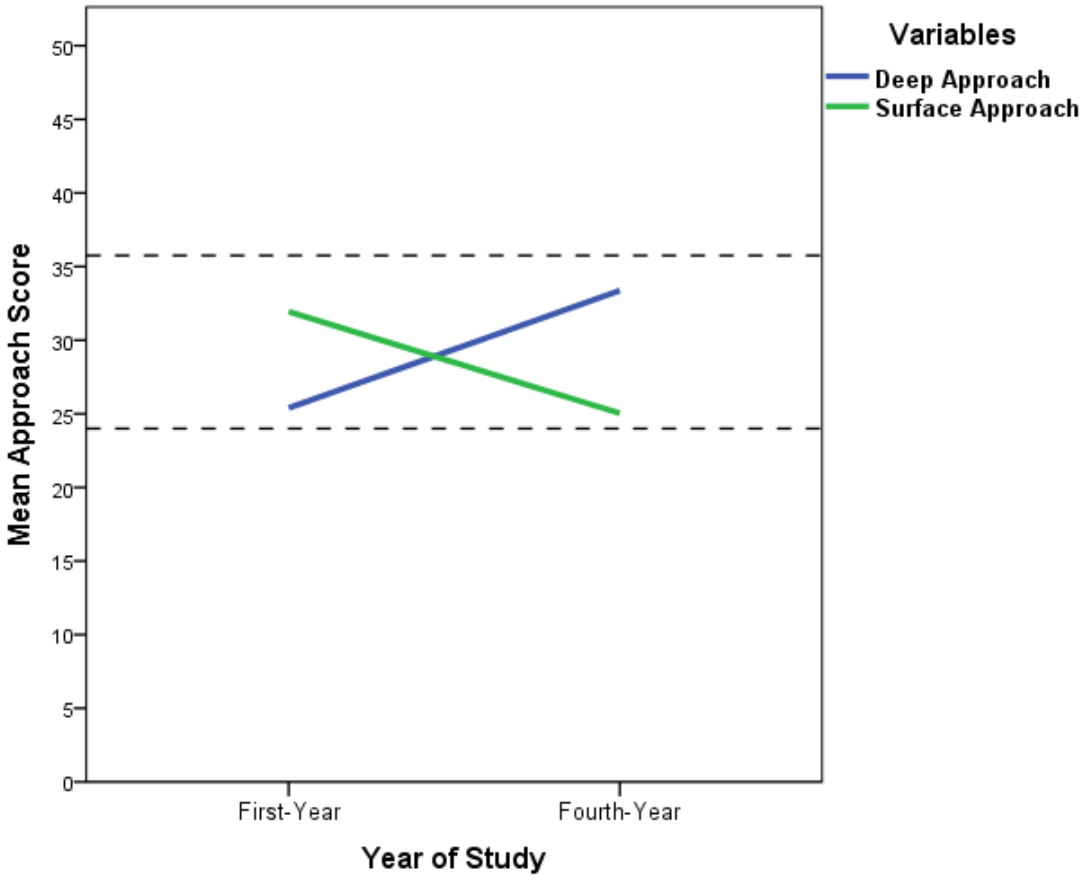


Figure 6 illustrates the positive trend between the independent variable of a student's year of study (blue line) and the dependent variable of deep approach, meaning that students who are nearing completion of their undergraduate program have a higher deep approach score compared to first-year students in similar programs. Figure 6 also illustrates the negative trend between the independent variable of year of study (green line) and the dependent variable of surface approach, meaning that students who are nearing completion of their undergraduate program have a lower surface approach score compared to first-year students in similar programs. It is important to note that this relationship is comparing two unique groups of students, and that a longitudinal study would yield more concrete results about the progression from a surface to deep approach throughout a student's undergraduate experience.

Program and approaches to learning. A one-way ANOVA was conducted to compare the effect of a student's program of study on their deep approach score of students. The effect of a student's program of study on their deep approach score was not statistically significant within the scope and sample size of this study, $F(6, 54)=1.959$, $p<0.05$, where $p=.088$. Additionally, a one-way ANOVA was conducted to compare the effect of a student's program of study on their deep approach score. The effect of a student's program of study on their deep approach score was also not statistically significant within the scope and sample size of this study, $F(6, 54)=.393$, $p<0.05$, where $p=.880$.

Graduate study aspirations and approaches to learning. A one-way ANOVA was conducted to compare the effect of a student's aspirations for graduate study on their deep approach score. The effect of a student's aspirations for graduate study on their

deep approach score was statistically significant within the scope and sample size of this study, $F(3, 57)=11.266$, $p<0.05$, where $p<.001$. Additionally, a one-way ANOVA was conducted to compare the effect of a student's aspirations for graduate study on their surface approach score. The effect of a student's aspirations for graduate study on their surface approach score was also statistically significant within the scope and sample size of this study, $F(3, 57)=11.266$, $p<0.05$, where $p<.001$.

Figure 7

Mean Approach Scores in Relation to Graduate Study Aspirations

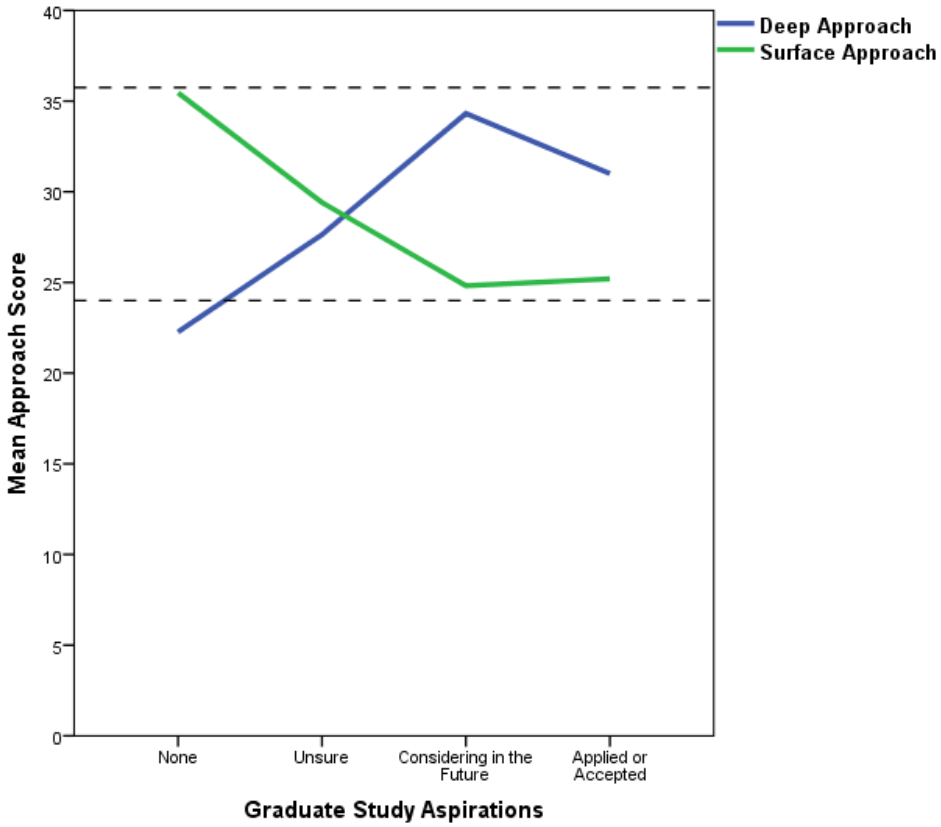


Figure 7 illustrates the relationships between the independent variable of graduate study aspirations with the dependent variables of mean deep approach score and mean surface approach score. There is a positive trend between the mean deep approach scores and students' aspirations for graduate study. Conversely, there is a negative trend

between the mean surface approach scores and the graduate study aspirations of students. This makes logical sense, considering those who move on to graduate programs would be likely doing so for reasons closely related to personal satisfaction, interest, and academic excellence.

Two-way ANOVAs. Two-way ANOVAS are used to understand the effect of a pair of independent variables on a dependent variable. Given the preceding one-way ANOVAs, I wondered if a pair of demographic factors affected the approach scores in a significant way. For this, I chose the independent variables of 'program of study' and 'gender', both of which independently were not shown to significantly affect the approach scores.

A two-way ANOVA was computed to compare the interaction effect of the two independent variables 'program of study' and 'gender' on the dependent variable of deep approach score. The interaction effect between the independent variables of a student's program of study and gender was not statistically significant on the dependent variable deep approach score, $F(5,55)=.410$, $p<.05$, where $p=.840$. A two-way ANOVA was also computed to compare the interaction effect of the two independent variables 'program of study' and 'gender' on the dependent variable of surface approach score. The interaction effect between the independent variables of a student's program of study and gender was also not statistically significant on the dependent variable surface approach score, $F(5,55)=1.031$, $p<.05$, where $p=.411$.

Qualitative Data Analysis

The qualitative data collected in this study was collected to understand more tangibly some of the lived experiences of the study participants. The qualitative data

collected through the survey were collected using open-ended questions on one page of the survey. For reasons unknown, some participants did not complete the qualitative portion of the survey, resulting in 52 (n=52) valid responses for analysis. Please note that participants were each assigned a random alphanumeric code to ensure confidentiality when quoting their responses in this document.

The open-ended questions were meant to provide participants a channel to respond freely and openly, while remaining anonymous. Unlike the data in the preceding quantitative analysis, the qualitative data cannot be statistically manipulated. Sentiments expressed in these responses may be unique or collectively similar. Nevertheless, the textual responses included in this section are valid precisely because they describe the lived experiences of students.

To begin the coding process, I printed the verbatim responses of participants. I first read the responses, and highlighted key words within the text of each response. I began open coding, broadly coding the responses as individual pieces of information. Next, I looked at the responses and began focused coding, grouping similar responses together. Finally, I looked at the groupings, and identified the constant theme emerging from the group of responses. I also made anecdotal notes next to some of the responses, making sure that I did not overlook important aspects of the story that these participants were telling through their responses.

Factors influencing approach scores. During the survey, after participants were given their approach scores and were informed of their dominant approach, they were asked to identify factors they believed influenced their learning in a way that would affect the results they received from the R-SPQ-2F. This was intentional, not so participants

would rationalize their results, but to identify specific factors that have affected their learning. This question was to have a similar effect on these participants as Marton and Säljö's (1976) questions of information processing had on their participants: metacognition.

Table 10 is a summary of the major themes which emerged from the analysis of the raw qualitative responses to the question *what factors might have influenced the approach to learning identified by your responses?* The responses have been selected from the overall set of responses, and represent the views of students with deep and surface approaches. I have made an effort to balance the viewpoints so that each group is adequately represented here.

Table 10

Participants' Self-Identified Factors Affecting Learning

Factors	**Sub-factors**	**Codes**	**Participant Comments**
Time	Time management	Make time; stay on track; timing; spending time;	"If I had more time, I would be able to look further into topics or do further research on topics discussed in class." *~Participant D-6*
	Perceived Lack of Time	Not enough time; more time; short; fatigue; limited	"Sometimes I feel like there is too much to get through in the time permitted. Also, I find myself rushing to keep up in some courses." *~Participant G-0*
Course	Course content	Hard; difficult; challenging; boring;	University math is much more difficult than high school math." ~Participant D-3
	Course structure	Too much; unreasonable; difficult; Heavy load	"A great deal of the courses I am taking give you a very large amount of material in a short amount of time." *~Participant C-0*
Strategy	Developed study skills	Developed; system of studying; group study;; "I don't"; "I often";	"I have a good system of studying, and my organizational skills are better now than they were 4 years ago." *~Participant F-6*
	Inability to cope	Don't know how to cope; cramming; stress; work ethic	"I just want to get into professional school so I study what's on the exams. But I have bad work ethic because I didn't need to study in high school to do well." *~Participant A-7*
Interest	Interested in studies	Like; interest; passionate; enjoyed;	I am passionate about what I study, because it leads to a job. I want to take the most from my university degree as I can." *~Participant E-1*
	Lack of interest	Disinterested; don't care; not interested; not practical;	"I'm not really all the [sic] interested in my program as I thought I would be so I don't put the effort into understanding deeper concepts." *~ Participant A-1*
Effort	Motivated	Motivated; success; curiosity; focus;	I am a TA… I can see the prof's point of view… there are things the prof would do that would make me motivated, or not." *~Participant F-9*
	Unmotivated	fatigue; break; hard; challenge	"My fatigue at the end of four years has led to me seeking a change in life." *~Participant D-8*

Table 10 illustrates the key factors (or themes) from the participants' responses, as well as sub-factors (sub-themes), codes, and selected participant responses. The themes were extracted from keywords and thematic groupings found within the responses, as no preconceived set of themes had been developed. In this way, it was my intention to let the participants tell me what they wanted to tell me, rather than have their experiences fit into a potentially narrow set of preconceived notions. With the exception of 'the course' factor, the responses were polarized, either addressing a positive or negative element of the factor the participant identified.

While most responses highlighted multiple themes, the dominant factor affecting students was time. Specifically, I noticed that many participants described a perceived "lack of time" to devote to their studies. Participant C-5 explained:

> "I prefer deep learning but I got a lot of surface score [sic] because I don't have enough time to spend extra hours going over things that won't be on exams. Yes I'd like to know more information, it's interesting. No, I don't have time to study things I won't be tested on regardless of what I find interesting."

This sentiment and others like it suggest that these participants are continually negotiating the boundaries of their learning based on their perception of available time. Participant B-9 put it bluntly when he said, "there isn't enough time to give 100% effort to everything if you also want a life." Realistically, there might or might not be a lack of time, but from the students' perspective, this may seem true.

The course itself was a stumbling block for a number of students. Participant B-5 explained how their "course load is extremely heavy; even if you are interested in a topic and want to learn more, you aren't able to because there are deadlines you have to meet

and time doesn't allow it." While Participant B-5 may have a specific timetable influencing his perception, a similar sentiment was expressed in the language of participant B-6 ("demanding"), participant C-9 ("hard"), and participant C-3 ("a challenge").

Another dominant factor identified by a number of participants was the level of interest they had in their studies. Some participants such as Participant F-7 explained that "I find what I am learning is interesting, and aligns with some core values I have about our world." Participant E-8 agreed, and added that "since I'm in my last year, I am taking courses I want to take instead of required courses," acutely aware of the luxuries offered to them as a fourth-year student. Other participants such as Participant A-1 identified an opposing feeling of disinterest in their studies: "I'm not really all the [sic] interested in my program as I thought I would be so I don't put the effort into understanding deeper concepts."

Definitions of learning. Fifty-two participants provided a response to the question what does *learning* mean to you? I coded the responses thematically, first by identifying key words through the analysis of the raw text. Next, I re-read and compared the responses. I categorized the responses based on the conceptions of learning identified earlier in Chapter 2 (see Table 3) and the results of this analysis were recorded in the dataset. The responses of participants were rich and varied, however all 52 responses could be confidently coded into the seven categories in Table 11. Using the rationale developed in Chapter 2, the seven categories have been broadly grouped into constructivist and non-constructivist groupings.

Table 11

Categorized Tally of Participants' Conceptions of Learning

	Conceptions of Learning	*n*
Non-constructivist	a) An increase in knowledge;	5
	b) Memorizing and reproducing;	7
	c) An acquisition of facts or principles, which can be retained and used in practice;	13
Constructivist	d) Understanding / abstraction of meaning;	15
	e) An interpretive process aimed at understanding reality;	2
	f) Changing as a person;	7
	g) A process not bound by time or context;	3

After I grouped the definitions of learning, I employed data transformation, a process where qualitative data is counted or given a numerical value, to quantify participants' open responses. I then cross-referenced the participants' responses with their deep and surface approach scores to see if there was any congruency between their definitions of learning and their dominant approach. To my surprise, I found that the majority of participants' responses (80.8%) aligned with their dominant approach. There was slightly more alignment between those with a dominant surface score (82.6%) than those with a dominant deep approach score (79.3%).

Table 12

Participants' Learning Conceptions Aligned with Approach

Dominant Approach	Definition	*n*	%
All Students	Match	42	80.8
	No Match	10	19.2
	Total	52	100.0
Deep Approach	Match	23	79.3
	No Match	6	20.7
	Total	29	100.0
Surface Approach	Match	19	82.6
	No Match	4	17.4
	Total	23	100.0

Table 12 suggests that there is a positive relationship between the actual experiences of the participants, the calculated approach scores, and the definitions provided. Consider the response of Participant D-0:

> [Learning] means to acquire new knowledge and experience in any kind of way. Learning is a process that continues indefinitely. Courses are vessels through which [students] can learn many new skills. Even from seemingly useless courses or classes, valuable skills can be learned.

Many of the definitions associated with non-constructivist notions of learning mentioned "memorizing" (Participant C-2), "acquiring knowledge" (Participant B-4), or "remembering stuff" (Participant A-7). It is important that I do not create confusion here. These responses are entirely valid and express the opinions of the participants as they should. From a constructivist approach, however, they are theoretically lacking what Potter suggested: that deep learning asks students to "apply and test ideas, use them, relate them to each other and to life, critique and evaluate them to make meaning" (2013, p. 3-4). Learning definitely results in "knowing more than when you started" (Participant A-8), but to leave the definition at that is problematic, and a more operational definition for learning is needed, as I proposed at length in Chapters 1 and 2.

The responses aligning to categories 'd', 'e', 'f' and 'g' were not only more tangible, they also included elements of learning which are observable and measurable. For instance, Participant E-8 believed learning "is to understand how something works, be able to replicate it, and adapt it using knowledge and skills to create something new or better." Participant E-4 agreed, and added that learning "is a process of trial and error…you try something and occasionally fail, but you try again and succeed." These

responses show the depth of learning taking place in these students' lives, as there is a reflective component to their definitions. In short, the lived learning experiences of the participants have influenced their cognitive definitions of *learning* as a concept.

Suggests to improve teaching and learning at the University of Windsor. The final open ended question asked in the survey was intended to provide participants an outlet to suggest possible avenues of communication between themselves and professors, staff, and administration at the University of Windsor. As before, I read the responses and highlighted keywords within them. I then began open coding, followed by focused coding. Again, as the research I did not want to get in the way of the narrative being produced by the participants' responses, so I did not use any predefined categories. What emerged were three dominant themes: (a) the improvement of teaching, instruction, and assessment; (b) the improvement of student learning; and (c) influences on administrative decisions' at the University of Windsor. Table 13 illustrates these themes, as well as the emergent subthemes, codes, and selection of participant responses.

Table 13

Participants' Responses to Improve Teaching and Learning at the University of Windsor

Theme	Subtheme	Codes	Participant Comments
Improvement of teaching, instruction, and assessment, at the University of Windsor	Cover appropriate content	Content is heavy; Too much to learn; More than facts; More interesting content	When the student [is trying] to understand something, include examples and multiple ways about thinking about the subject since everyone thinks differently. And not just telling us the facts…explain why they are true, allowing us to have better understanding." *~Participant C-4*
	Improve instructional methods	Less lecturing; Incorporate active learning; Less textbooks; More hands-on labs	"The CS program is quite good, but I'd like to see less lecturing and more activities in some areas." *~Participant E-4*
	Clarify assessment and evaluation	Exam format; Modify timeline of course; Too many assignments; Overlap of assignments	"Cumulative final exams make it extremely difficult to 'learn' all the material because there is so much to study. When you have so much material to study for 1 class, you often don't have enough time to deeply understand the material." *~Participant A-3*
Improvement of student learning at the University of Windsor	Make learning tangible	Make real-world connections; Show how to apply concept; Transfer of skills;	"Show us how we can apply what we're learning tot real life." *~Participant A-9*
	Know what students need	Motivate students; Stimulate self-learning; Course expectations;	"Understanding what most students expect from a course could allow teachers to work with those expectations, not against them." *~Participant D-4*
	Know who students are	Find out how students learn; Know the learners; Listen to student concerns;	"I would like to see professors find out more about the students they teach to make the class more exciting for us*." ~Participant C-6*
Influences on Administrative decisions at the University of Windsor	Promote faculty development	Review teaching practices; Professional development;	"The university should show this research to my prof, so that next year the course is better." *~Participant A-8*
	Minimize apathy	No confidence in system; Conflicting expectations;	"It won't. Nothing ever changes. Noting ever will." *~Participant A-4*
	Evaluate institutional effectiveness	Course/program planning; Recruitment in STEM; Program sequencing; services;	"The information from this research can help the university plan courses and help understand the services students might need." *~Participant E-6*

If the themes from Table 13 seem familiar, it is because they are. Most of the themes which emerged from participants' suggested uses for the data from this research mirror the factors which have influenced their approach to learning. This isn't surprising considering those who have factors negatively affecting their learning would surely want those factors to be addressed. Students identify a direct relationship between the actions of their instructors to create learning environments and their ability to and quality of learning. Participant F-9 believed "profs [sic] should know how students approach their learning in their class so that students can have a great experience and learn as much as they can."

The most prominent theme which emerged from the participants' responses to this last question was to use their responses to inform the improvement of teaching at the University of Windsor. While each student already provides summative feedback to the institution at the end of each course taken, the popular sentiment was that this information is not as specific or as timely as it could be. Participant A-8 wished that "the university [would] show this [research] to the prof, so that next year's course is better." Specific suggestions for improving teaching were made by Participant A-3, who stated that "cumulative final exams make it extremely difficult to 'learn' all the material because there is so much to study." Similarly, Participant E-2 noted that many "courses have a lot of assignments, and some are repetitive and time-consuming." One suggestion to combat this seeming prioritization of content is what Participant E-7 described as "a hands-on approach" to learning, which asks students to make meaning for themselves through activities "rather than textbook based learning."

Participants did not simply gripe about their professors, however. Many took the approach that learning could be improved through the release of the results of this study. Motivation is a word that was used by a number of participants, most notably by participant E-0:

> [Learning] could be improved by keeping the material practical and reasonable, and with the right push of intrinsic motivation, will have students participating in lectures. I always feel off of professors being interested about what they teach. I care for the material if they care for it while they break things down.

While motivation is not something that was measured in this research, it is interesting that the correlation is made by Participant E-0 and others. The connection is related to the findings of Duckworth, Quinn, Lynam, Loeber, and Stouthamer-Loeber (2011), who found that motivation was found to be a better predictor of future academic success than a high IQ test score. The responses from students, whether coming from those identifying a deep or surface approach, seem to come from students that are willing to put in effort if given the motivation to do so.

A number of participants alluded to their identity as a student being underplayed in the learning process. Specifically, some participants suggested that their views could be better represented. As a fourth-year student, Participant B-5 hoped that this research would "help teachers alter their decisions in how they teach." Participant G-0 was equally interested in being heard, wishing that "[the results from this study] might help professors understand how we feel as students."

Some participants suggested that university leaders and administrators be privy to the suggestions of students. While the questions of the R-SPQ-2F did not address policy

or administration of undergraduate education, it was clear that some participants felt there were systemic issues hindering student learning. These responses suggest that more communication could occur between students and administration; however, only a handful of students alluded to institutional issues in their responses. Addressing a known gender disparity among STEM (science, technology, engineering, and mathematics) disciplines, Participant E-8 mentioned that he and "some students in [Computer Science] think that there aren't enough women studying in our program." Consulting the enrollment statistics for the department of computer science, Participant E-8 is quite accurate: there are 383 males, and only 46 females.

Through a detailed analysis of the approaches to learning and the beliefs, opinions, and suggestions of this cross-section of undergraduate Faculty of Science students at the University of Windsor, it is clear that learning is not easy to define, measure, or improve. The deep and surface approach scores of participants show a faculty that takes teaching and learning seriously, eliciting a collective sigh of relief from those in Essex, Erie, and Memorial Halls. What has emerged from the detailed exploration of participants' responses to the three open-ended questions from the survey is a rich array of beliefs, interests, suggestions, and insights. When paired with the qualitative data, the picture of teaching and learning in the Faculty of Science at the University of Windsor becomes a little clearer, while at the same time leaves many questions unanswered. These data should not be the end, but only the beginning in an effort to understand teaching and learning in the Faculty of Science. In the following chapter, I discuss the collective results of this research, propose next steps beyond this research study, and address some inherent implications for research, practice, and policy.

CHAPTER 5: DISCUSSION

The data collected during my study has been thoroughly unpacked in the preceding chapter. The results I have gathered from the data in the previous chapter describe how learning is perceived by the students who participated in the study. The quantitative data explored the deep and surface approach scores of participants, and exposed trends between demographic groups. The Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) revealed the approaches to learning that these students take to their undergraduate education. Statistical analyses, such as factor analysis and ANOVAs, provided evidence as to the reliability and validity of the study, as well as the potential to draw conclusions based on the dataset. The qualitative data collected, on the other hand, personified the scores collected using the R-SPQ-2F. This data was thematically rich, with strong collective sentiments expressed. Their lived experiences shone through in the responses they provided to the three open-ended survey questions. The study offered students from the Faculty of Science at the University of Windsor a platform to voice their opinions. Through their participation, these students were given a voice.

At this point, I am reminded of the initial questions guiding my research. For reference, I have included them here:

Which student approaches to learning are undergraduate science students at the University of Windsor identifying as their dominant approach?

a) *How do students define learning?*
b) *Do participants' dominant approaches to learning align with their definitions of learning?*
c) *What factors are contributing to the dominant approaches identified?*

d) *From the student perspective, how might the identification of student approaches to learning be useful to inform university teaching, learning, and educational development?*

Through the analysis of the data, all five of the research questions have been addressed. Many of the intricacies of the questions were outlined in the preceding chapter. However, I believe that these questions are best addressed by exploring the convergence of the quantitative and qualitative data, and how that convergence informs this discussion. Using a modified conception of thematic analysis which included analysing the meaning extracted from statistical calculations, three overarching themes emerged: (a) deep learning is happening; (b) there are (seemingly) perpetual factors influencing student learning; and (c) students want and need a voice. I will explore these three themes in greater detail using statistical results and participants' own responses as evidence. Afterward, I will present the implications of this research for research, practice, and policy, and conclude by addressing the limitations of this study.

Theme 1: Deep Learning is Happening

This first theme is predicated on an interpretation of the quantitative data, which measured tangible questions about studying habits and attitudes. It quickly became clear that some demographic factors affected the approach scores more than others. Significant factors which affected approach scores were a student's year of study (deep, $p<.001$; surface, $p<.001$), age of the student (deep, $p<.001$; surface, $p=.003$), and a student's aspiration for graduate study (deep, $p<.001$; surface, $p<.001$). There were other factors, namely gender and program of study, which did not have a significant effect on approach scores, statistically or otherwise.

Figure 8

Average First-Year Approach Scores by Department

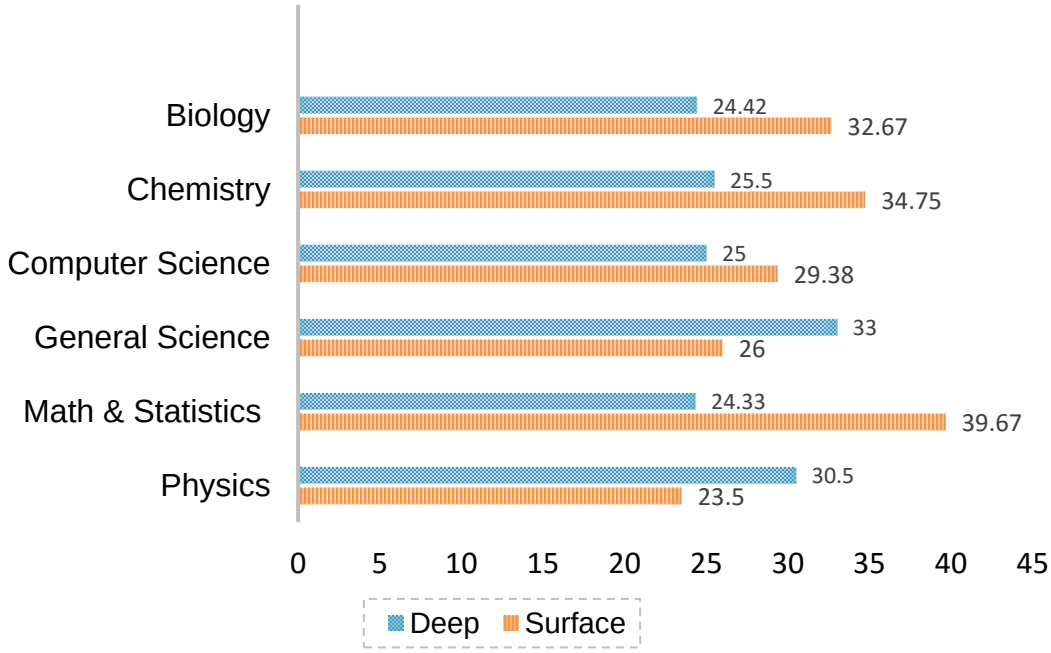
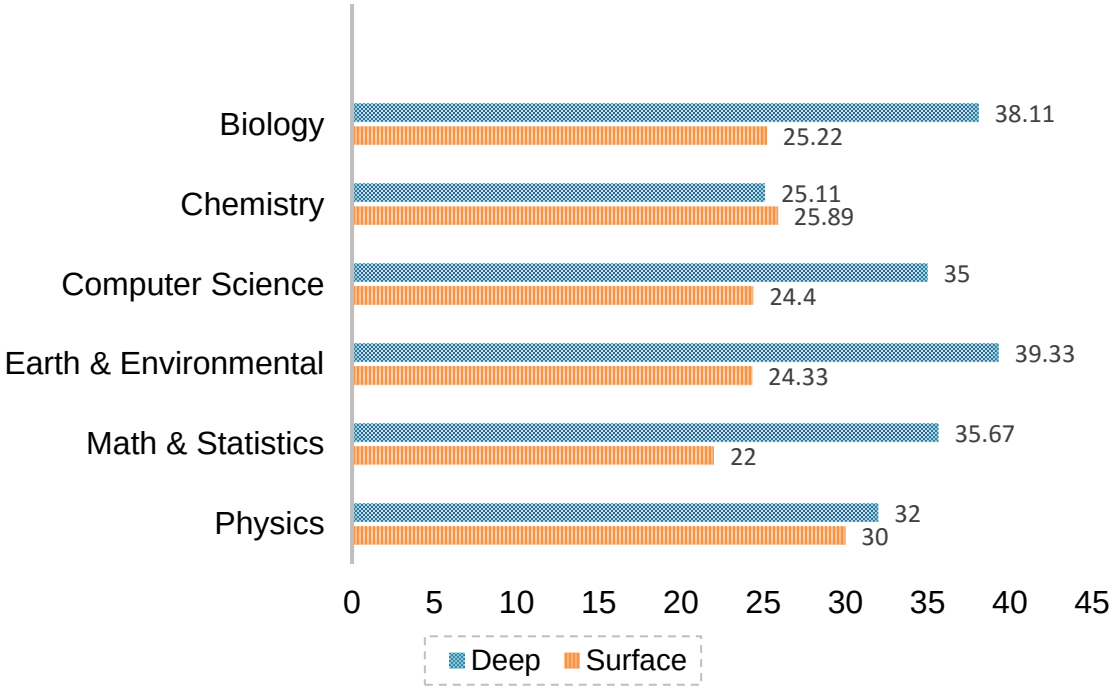


Figure 9

Average Fourth-Year Approach Scores by Department



An important finding is that fourth-year students who participated identified on average a significantly higher deep approach score and significantly lower surface approach score. What makes this finding poignant is that this shift in dominant approach was seen in the majority of departments. As shown through Figures 8 and 9, there is a complete reversal of dominant approach in the departments of Biology, Computer Science, Math and Statistics, and Physics. While the sample did not show that the department of Chemistry's dominant approach changed, the difference between the deep approach and surface approach averages are almost equal (deep, M=25.11; surface, M=25.89) and shows a shift similar to the other departments.

The shift from surface to deep could have occurred through faculty, departmental, or program level educational development, the impact of extracurricular activities (such as *Science Academy*, an educational program organized and facilitated by undergraduate science students for local secondary school students), increased research collaboration between faculty and students, or some other initiative. Regardless, there are additional influences, which seem to be having a positive effect on students' approach to learning. A research study into the specific initiatives of the Faculty of Science could provide a tangible explanation to the increase of deep learning approaches, as well as identify practices which deserve continued effort and resources allocated to them.

Interestingly, most fourth-year students (76.7%) identified a deep approach as their dominant approach to learning. Also interestingly, only one third (33.3%) of first-year students identified a deep approach as dominant. I cannot say what the fourth-year students would have scored in their first year of studies, but it is entirely possible that their outcomes would be similar to the first-year students in this study. If so, what types

of experiences caused these students to adopt a deeper approach? A future research project is warranted, as this phenomenon deserves more attention.

Another promising result of the analysis of the student approach scores is the connection between student aspirations for graduate study and approaches to learning. Biggs et al. (2001) suggest that students who are interested in graduate study might have higher deep approach and lower surface approach scores. This was found to be true with the sample of students in this study, as 22 of the 33 (67%) students with a dominant deep approach identified that they were considering, had applied, or had been accepted to a graduate program. Interestingly enough, the same percentage (67%) of students identified that they 'always or almost always' or 'frequently' "make a point of looking at most of the suggested readings that go with the lectures" (Biggs et al., 2001, p. 19). When looking specifically at fourth-year students, 19 out of 23 students with a dominant approach (81%) answered in this way.

This finding connecting students with serious graduate aspirations to the deep approach to learning shows a level of rigour on the part of these students. These students identified high levels of commitment to learning as evidenced by their responses to questions on the R-SPQ-2F. Faculty members should make every effort to foster the study habits and dispositions that are "always or almost always" and "frequently" practiced by students with graduate aspirations: working diligently out of an interest for the course or material (88.9%), self-testing of course material (81.5%), reading course texts (67%), and feeling personal satisfaction when studying (59%). Doing so sets students up to successfully learn rather than simply retain information. It is important I clarify that this study does not suggest that an inverse relationship (i.e., that students why

identified a deep approach all have aspirations for graduate study). There are many hardworking students whose interests lie in specific specialized careers. Future career goals were not assessed in this study, but are probed through other administrative surveys such as the *National Survey of Student Engagement (NSSE)*.

Practically speaking, it seems as though deep learning, defined through a constructivist lens as learning which takes the process of learning into account, is happening in programs in the Faculty of Science at the University of Windsor. For a faculty whose programs are seen as champions of industrial innovation and scholarly research, the addition of evidence showing deep learning further promotes the reputation of the Faculty of Science. This finding seems to indicate that the Faculty of Science – and indeed, the University of Windsor – is a champion of deep learning at the undergraduate level. Yet it is difficult to make claims like this without additional research, and these claims could be further verified through more strategic research projects.

Theme 2: The (Seemingly) Perpetual Factors Affecting Learning

A student's approach to learning is predicated on their perception of the learning environment. Participants' responses to the first open-ended online survey question (*what factors might have influenced the approach to learning identified by your responses?*) identified a number of factors which they felt had impacted their learning in some way. The candid responses of the participants identified a number of factors that they felt either positively or negatively affected their learning. The open-ended nature of the question was to invite students to share as much or as little as they chose to. I deliberately chose the word "influenced" rather than "affected" so that the question did not imply that I was looking for positive or negative factors. As a result, the participants

shared both. Things such as the "very large amount of material" (Participant C-0), the need to "study only the topics that are covered in examinations" (Participant D-6), and a perceived lack of time were key indicators of students who had been negatively affected in some way. Conversely, other students shared that the best courses "make me motivated to work" (Participant F-9), "are discussion focused" (Participant D-2), and stress that "understanding is a must" (Participant E-5).

In the previous chapter, Table 13 illustrated the diversity of participants' previous challenges affecting their learning. When I read the responses, none of the factors on the list were surprising to me. I noticed that the items these students identified were not unique or sensational. In fact, they were things I struggled with as an undergraduate student; they were things that I thought had changed since then. I too had a difficult time understanding "a very large amount of material in a short amount of time" (Participant C-0). I too wasn't "as interested in my program as I thought I would be" (Participant A-1). I too "didn't know how to do it on my own," because those skills were not valued as important in my prior learning experiences (Participant A-8). The collective struggles of the participants, when combined, verify that these challenges are real. In order to minimize some of these factors risking successful learning, student services such as the *Skills to Enhance Personal Success (STEPS)* program, which helps students develop effective study habits. Academic advising and students' participation in peer learning experiences can also have a positive effect on mitigating student concerns.

By the accounts of my research, the Faculty of Science seems to be positively affecting student learning and working to change the mindset of students who have survived learning experiences that promote a surface approach to learning. Participant B-

3 shared eloquently about how his experiences have made him seek out a specific learning environment:

> While a surface approach is oftentimes appealing for the sake of trying to save some mental energy, or more often, time, it is ultimately not effective, especially in the scientific field. Memorization of information without a deeper understanding of it is a pointless endeavour. The reason is that advancement in this field only happens when relevant and widely applicable concepts are applied to different problems. You cannot solve a problem by regurgitating memorized words or equations. You have to know what they mean in order to know when it is appropriate to use them.

The type of learning Participant B-3 spoke about is exactly what universities should be promoting. Students should be engaging in higher order thinking, meaning-making and interacting with one another to achieve higher level outcomes. Hattie et al. (1996) suggest that "the intention is to help students understand content with a view to applying it in a new context … [recognizing] that different tasks will require different approaches" (p. 129-130). Numbered, it seems, are the days when memorized facts are the highest form of knowledge. The ubiquity of Google has put information at the fingertips of today's generation of young people (Prensky, 2001). The meaningful extension of theoretical concepts to practical applications can be done through co-op placements integrated into undergraduate programs of study or the promotion of undergraduate research initiatives, such as the *UWill Discover Undergraduate Conference*, a yearly conference that promotes undergraduate research and scholarship at the University of Windsor.

Theme 3: Students Want and Need a Voice

One of the implicit goals of my research was to provide students with an appropriate outlet to communicate how teaching and learning could be improved at the University of Windsor using the results of this research. This was not simply a space for students to rant or gripe, but for them to be actively involved in the process of teaching and learning, and to allow their unique perspectives to be valued by the readers of this research, including: fellow students, professors, educational developers, administrators, or other researchers.

Participants' responses to the final open-ended online survey question (*from your perspective as a student, how could this information help make teaching and learning better at the University of Windsor?*) revealed three distinct categories of improvement: teaching, 'learning, and administrative. Where answers to the first question describing factors influencing student learning were largely introspective, the sentiment expressed in responses to this final question were more prescriptive, inspired in many cases by personal experiences. For a detailed description of participant responses to this question, please see Table 13 in the previous chapter.

It is entirely appropriate that at some point, students would respond with constructive criticism towards those to whom they entrust their undergraduate education. An overwhelming number of responses provided a response which suggested improvements to teaching, be in instructional methods, assessment strategies, or content refinement. One student suggested that "lectures could be more dynamic and interesting" (Participant B-1), and another would like to see "different activities in class" (Participant C-8). Other students accepted the method of instruction, but alluded to a perceived

disconnect between the way they were being taught and the method of which they were being assessed, and the lack of *authentic assessment*: assessment through demonstrable real-life tasks. In relation to this notion of authentic assessment, Participant A-3 noted that:

> Cumulative final exams make it extremely difficult to 'learn' all the material because there is so much to study. When you have so much material to study for 1 class, you often don't have enough time to deeply understand the material. I often memorize things more than understanding [sic] them.

Students like Participant A-3, who take a surface approach to their learning, expressed their perceptions of their learning environment bleakly. This is a classic example of the approach to teaching influencing the approach to learning. Originally a chemistry lecturer, Keith Trigwell (1995) explains that "science lecturers are aware that there are different [teaching] strategies … [and] interactive methods" but to adopt them "some faculty may themselves need to undergo a conceptual change" (p. 77). Trigwell (2010) acknowledged that "studies that show relations between what teachers do and what their students do are uncommon in higher education" (p. 118). Unfortunately, this further highlights the gap between research and practice outlined by Wright (2010).

It was only by distancing myself from the specific comments that I realized this last theme embodied more than just the collective suggestions of the student participants. As I read the comments after coding, the collective voice of the students emerged. As if in unison, they seemed to be telling me that they had something to say, and that they wanted to be heard. While some participants such as Participant G-0 were brave enough to suggest that professors read this study "to understand how we feel as students," others

communicated the same sentiment in the tone of their response. Participant E-0 offered unique advice for her professors, in the hopes that they would listen:

> Keeping the material practical and reasonable, and with the right push of intrinsic motivation, will have students participating in lectures. I always feed off of professors being interested about what they teach. I care for the material if they care for it while they break things down.

Ramsden (1997) understood that "interest and commitment to a subject area can be fostered by certain experiences of teaching and by perceived freedom in learning" p. 215). Participant E-0 did share that a specific professor did motivate her, and that she was thankful for his effort to do so.

Some participants felt comfortable enough to be honest, and did not censor themselves. For this, I acknowledge and thank them. Teaching is such a personal undertaking that criticism can be tough to take. Participant B-5, a student who had a strong deep approach, was still compelled to share his thoughts:

> The information [from this study] could be shared with professors so that they know where students stand in terms of knowledge obtained as well as the workload we have, therefore helping alter their decisions in how they teach. I can't think of a single professor I had in any of my science classes that showed any enthusiasm for teaching us as a class. There is definitely no empathy for students…if they only want to do research then please give them that option and get people who actually care about teaching to be our professors because it's not fair to the students.

My intention is not to diminish the hard-working science faculty members by including this remark, but to illustrate my point: student perceptions include opinions, but they have constructive value. This student's remark might seem harsh or unjustified. However, Jill Kinsie (2010) recommends that institutions value "high-quality student-faculty interactions, rigorous [sic] levels of academic challenge and high expectations for students, active learning, diversity experiences, and peer interactions" if they are serious about improving student success at the undergraduate level. In some ways, Participant B-5's comment is antithetical to Participant E-0's comment earlier in this chapter. The only difference between the two comments is perspective. In order for teaching to improve the quality of learning for students, it must take into account the concerns of all students, not simply the majority.

Implications

To some, these findings might seem ground-breaking. I admit that I find them to be so, as they describe the student perceptions of learning much clearer than what I had expected to find. As the focus of my thesis changes, it is important to "mind the gap between…current knowledge and several unresolved research and application questions" (Wright, 2010, p. 155). Wright explains that "the research between teaching and learning in higher education must be linked to the realm of educational development" (p. 163). What might be the implications for research in this area? What are the implications for teaching and learning on the Faculty of Science, and on the University of Windsor in general? Does this research have implications on policy?

For research. This study's results largely depict a faculty whose students' learning approaches are significantly affected by year of study and age, unlike the results

of other studies (Ramsden & Entwistle, 1981; Tural Dincer & Akdeniz, 2008). Additionally, this research is identifies a group of students who have not been asked to reflect on their study habits in order to understand their approach to learning. I suspect research concerning student approaches to learning is scarce at the University of Windsor for two reasons: (a) the notion of student approaches to learning are foreign to most faculty who have not explored the literature related to teaching and learning; and (b) the use of an instrument such as the R-SPQ-2F brings risk, discomfort, and allocated research energy 'outside of my discipline'.

This study could be replicated in other faculties or departments fairly easily. The resources needed are widely available, and the value is worthwhile. The ability to compare departments would be helpful in order to create a more complete picture of teaching and learning at the University of Windsor. Other institutions, especially those who have not measured the quality of learning, are missing vital information from a key group of people at their institution, the students. Replicating my study offers students a voice they may or may not feel they have.

A longitudinal study into student approaches to learning can validate the claims I have made about trends in approach scores. Other studies have succeeded in doing so (Ramsden & Entwistle, 1981; Watkins & Hattie, 1981). Rather than comparing two different groups of students, one group can be looked at more in-depth, and specific influences from their undergraduate education can be explored.

A number of students identified motivation and effort as factors which affected their learning in some way. There have been strong links between motivation and student learning (Biggs & Tang, 2011; Trigwell, 1995), but this study did not look at motivation

explicitly. Future studies might make specific connections between student approaches to learning and motivation, identifying those variable which are motivating and this which have a negative effect on student motivation.

There are additional variable that could be factored into future research studies of this kind. The course offerings in fourth-year (i.e., specialized electives with low enrollment) are different than those of first-year (i.e. survey and introductory courses with large classes). These course environments are a possible source of influence. Cross referencing of participants' final grades has been done in other studies (Wiese & Newton, 2013), and would pair the formal assessment of course success with learning approach data, providing a more complete picture of student learning. As a student' I would have difficulty obtaining other students' grades, so this might be more suitably undertaken by an individual instructor using the R-SPQ-2F as a means of understanding student perceptions of learning in a specific class.

For Practice. Perhaps it is expected that the first implication for practice will be to encourage instructors to use the Revised Two-Factor Study Process Questionnaire to understand the students they teach. That assumption is only partly true. I do think that the brevity of the instrument coupled with the almost instantaneous results make the R-SPQ-2F a useful one for a number of uses, as Biggs et al. (2001) suggest. It might be also useful, however, as one source of feedback integrated into a critically reflective *self-evaluation plan*.

A self-evaluation plan is a methodical approach to assess your own teaching in order to understand the effect your actions have on the learners. This was one of the main concerns of students, that "the university should show this to my prof, so that next

year the course is better" (Participant C-8). Those who are seriously invested in education can and should be reflecting on their craft. The lack of meaningful teaching, according to Knapper (2010), is because "instead of reflecting on their own experience, supplemented by relevant research about effective practices, many faculty base their approach to teaching upon an uncritical adoption of the model that comes most readily to hand – their own professors" (p. 230). This means that faculty should find some meaningful way to assess the results of their teaching efforts. Stephen Brookfield (1995) identifies five sources of information that instructors can use to reflect on their teaching: (a) the "autobiographical" self; (b) students; (c) colleagues; (d) theoretical literature, and (e) empirical literature (p. xiii). For some, the ideal tool might be teaching evaluation data. For others, it might be student feedback. Still others might dig into SoTL publications, or studies such as this one. Brookfield makes it clear that perspective is important, ideally considering multiple perspectives and triangulating the information used in self-evaluation.

If student-centred teaching is to become the standard for undergraduate education on Ontario, there must be action taken on the part of the instructor to implement "teaching methods that stress student activity and task performance rather than just the acquisition of facts" (Knapper, 2010, p. 240). Resistance to change is all too common, and unfortunately "many faculty members, especially those in large research institutions, may be skeptical of what they regard as pedagogical fads" (Millis, 1995, p. 140). This direct connection between an instructor's approach to teaching and a student's approach to learning is one of the main concerns of Biggs and Tang (2011), especially when

learning is viewed as a process rather than the result. The R-SPQ-2F could be used to assess the effect of a newly-adopted pedagogy on a class.

The quest for good teaching and learning isn't a solo effort on the part of one faculty member, as evidenced by the participants in their suggestions for the use of this information. One necessity to change the teaching culture of an institution is to have collaboration among all involved in teaching and learning. At last count, there are 20 or so centres of teaching and learning (or some similarly-named office) operating on university campuses in Ontario. It is important that those centres continue to live up to their mandate and be "catalysts for discussion and innovation" (Knapper, 2010, p. 238). Others might head in a different direction and use the knowledge of their colleagues and peers. For example, some faculty at the University of Windsor have developed the *Peer Collaboration Network (PCN)*. The PCN is a professional development opportunity where instructors "can develop their own teaching practices, which, when considered collectively, will enhance teaching practices across all academic units at the University of Windsor" (University of Windsor, 2016).

For Administration and Policy. My thesis might be seen like a 'feel-good' story if it reaches the desk of senior administration at the University of Windsor. If that is all it is seen as, then part of this work was for naught. There are a number of implications for administration and policy that should be considered in light of this research.

Currently, the University of Windsor is transitioning to a new funding model the *UWindsor 2.0 Enrolment-Centred Model*. Essentially, this new form of budget allocation keeps government grant money central, and tuition dollars are the funds used to run departments and faculties. It isn't my intention to comment on this decision by the

administration, but the adoption of this budget model does bring with it implications. When departments' budgets are based on enrollment (as activity based budgeting will ultimately dictate) it is important that administration not lose sight of the students as learners. It is cheaper to have large classes, and promote surface learning mentalities in the name of efficiency. I believe that the University of Windsor has the opportunity to promote deep learning and an excellent student experience without allowing neoliberal ideas of the student as 'consumer' to disenfranchise students. In fact, a continued commitment to quality teaching and learning could work to drive enrollment at the University of Windsor, furthering the already positive reputation of the institution. This same advice goes to other institutions as well, who are no doubt trying to run leaner budgets.

A number of students made reference to faculty development in their responses. Participant D-9 pointed out that "just because a professor has a doctorate does not mean they can tell me what they know." I do think it would be unreasonable to ensure all professors "have been to teachers [sic] college," but some sort of instructional workshop or certificate could be a benefit (Participant A-7). The problem lies in doing so in a way that does not create a mandated program which becomes trivial because it is mandatory. For now, opportunities such as the University of Windsor's *University Teaching Certificate* (UTC) remain available for those who decide to benefit from them.

Limitations of the Study

Research "requires discipline, clear thinking, and careful observation" (Bouma et al., 2012, p. 15) if it is to produce results that can advance the field of research in a given discipline. These three tasks were challenging for me, having undertaken my first major

research project within the confines of the thesis process. The mentorship I have received has been a driving force pushing be to believe in myself as a rookie researcher. By no means was the path linear; I weaved back and forth, debating with myself about semantics, process, and sequencing, ultimately making decisions I am proud of, and others that have served as learning opportunities. For example, the research questions that appear in this document have morphed over the course of a year and a half of coursework and discussion with mentors and colleagues. The process of writing this thesis has been one of growth, and one of the most rewarding endeavours I have undertaken, academic or otherwise.

Despite my best efforts to adopt research practices that are sound, however, there are nevertheless some limitations of this study. As I've noticed from the literature I've read, it seems that there are always limitations of some kind, but the key is to identify those that cannot be avoided, and those that were only found to be limitations as the project went on.

Overall limitations of my study include time and financial constraints. My study would be entirely replicable as a longitudinal study, following a cohort of students through their undergraduate education. While the cross-sectional design I employed provided meaningful results, a longitudinal study would offer comparisons between the same set of students rather than comparing two groups whose starting point was never identified. Unfortunately, a Master of Education thesis cannot take four years, rendering a longitudinal study impractical. As I am a student researcher at this point, compensating participants was not possible, but may have had a positive effect on participation rates.

The first specific limitation of this study is in regards to the generalizability of this study's results. The University of Windsor is a unique postsecondary institution, and while similar findings might occur in studies at other postsecondary institutions, they would need to be found through separate studies. Within the University of Windsor itself, it would be imprudent to assume that the results of this study could adequately describe students in other faculties. Again, there would likely be similarities due to common factors between the students, but those cannot be assumed. To understand fully any group of students outside of those this study represents would be best done by replicating this study in another department or faculty.

Affecting generalizability is the number of participants who took part in this study. The sample size of this study was lower than expected. While online surveys typically bring low survey response rates (Kraut et al., 2004), the response yielded only half of my anticipated response of 135 participants (15%). I attribute the lower response rate to the timing of the research (at the end of the academic year) and the lack of monetary incentive for the participants. While the timing of this research was unavoidable, in subsequent studies, the participant response rate could be increased by using a draw to provide incentive.

Despite the size of the research sample, nonresponse bias seems unlikely. The responses of students are hardly polarizing, with responses spread throughout the range of deep and surface approach scores. For a logical scenario of nonresponse bias, there would have been a lack of deep dominant approach responses or a lack of surface dominant approach responses. Still, given that the majority of students chose not to respond, it is possible that they hold the majority viewpoint. Self-selection is related in

this respect, as students who are deep learners would likely seek out opportunities to participate in the research. Similarly, social desirability might be considered a limitation, as participants might be tempted to say that their study habits are better than they are. I stressed throughout the communication with participants (i.e., recruitment letter, letter of consent, and survey instructions) that participants were free to respond in a way that they felt comfortable, and that they should respond with an accurate representation of themselves. I believe the fact that I am also a student --one of them—helped to create as welcoming an environment to participate as possible. Given the congruency of qualitative responses with the statistical scores, this seems unlikely but again, possible.

Methodologically, the R-SPQ-2F was an appropriate instrument for the study, however, I created the open-ended questions and demographic questions organically, as the project continued on. They were only informally piloted, and I would have preferred to test them more robustly prior to launching the survey. While the open-ended questions are meant to give participants the ability to share of their own experiences, it could be said that they were valid and reliable, as compared to the quantitative data.

CHAPTER 6: CONCLUSION

As seen in the literature and through the students who participated in this research, each undergraduate student makes choices and acts in ways which influence their learning. A student's approach to learning is a measure of these actions and decisions. The analysis of student approaches to learning can be useful to assess teaching, develop programs and courses, and understand the student experience. Instructors, educational developers, and administration all benefit from student learning data. The aim of the current study was to identify the approaches to learning of students studying in the Faculty of Science at the University of Windsor, to better understand student perceptions of learning.

Early research into student learning suggested that there are two distinct levels of processing, *deep level processing* and *surface level processing* (Marton & Säljö, 1976a). Through research at many institutions around the world, these two levels of processing have adapted into the *deep approach to learning* and *surface approach to learning.* There are a number of different educational psychologists and scholars working to promote deep learning (e.g., Biggs, Entwistle, Kember, Potter, Prosser, Ramsden, Trigwell, Wright, etc.)

The guiding research question of my study was: *which student approaches to learning (SALs) are undergraduate students at the University of Windsor identifying as their dominant approach?* I do not know of any other study that has investigated student approaches to learning at the University of Windsor. There are indeed only a handful of recent studies that have investigated student approaches to learning in the context of postsecondary education in Ontario (Acai & Newton, 2015; Kirby et al., 2008; Newton &

Wiese, 2013). This study not only addresses this gap in literature, but provides meaningful information about student learning at the University of Windsor. My study achieved this by employing a mixed methods convergent parallel design, which collected both quantitative and qualitative through an online survey. Student participants in the study were first-year and fourth-year students studying in the Faculty of Science at the University of Windsor. Through targeted email recruitment, 60 participants were recruited. The data I collected included responses to the Revised Two-Factor Study Process Questionnaire (R-SPQ-2F), responses to open-ended questions about their learning experiences, and demographics.

This study addressed that question through the calculation of deep and surface approach scores of all participants (N=60) based on their responses to the R-SPQ-2F. The responses were tallied and categorized by the demographic variables. From the raw data, I found that from the group of students who participated, some were taking a deep approach to their learning, and others were taking a surface approach. When I investigated the data further, I found that for this group of students, the approach they took was correlated with their year of study, and consequentially, their age. Statistical analysis confirmed that for these students, the effect of their year of study and age on their deep and surface approach scores was significant.

Additional research questions were explored and asked participants to provide information about their learning experiences and their personal conceptions of learning. These responses provided a narrative to pair with their approach scores, and identified that there are a number of contextual factors affecting their learning. Additionally, their

conceptions of learning seem to be correlated to the approach they identified as their dominant one.

Through analysis of the data and the convergence of the quantitative and qualitative datasets, three themes emerged. Participants' scores and statements revealed that (a) deep learning is happening; (b) there are (seemingly) perpetual factors influencing learning; and (c) students want and need a voice. These three themes have been explored through poignant connections between the responses of the student participants and the literature. The three themes illustrate the teaching and learning situation in the Faculty of Science at the University of Windsor, and produce implications for policy and administration, practice, and future research.

The current study was designed to benefit the students who participated. Students received the results of the quantitative component of the survey, and were provided with their deep and surface approach scores, as well as a small description of each approach. The very act of participating itself provided these students with an appropriate outlet to communicate their beliefs and concerns. This group of students implied that they felt empowered to speak up through their participation. Students are the recipients of the teaching efforts of the university, and my study valued their perceptions of their learning environments as they described them.

The approaches students take to learning can be influenced by the approaches instructors take to their teaching. While research consistently identifies this, faculty members "continue to teach in ways that are not particularly helpful to deep student learning" (Christensen Hughes & Mighty, 2010). There is a need for instructors to engage in self-reflection and professional development. Administration has a role to play

in the promotion of deep learning, and must recognize that students are much more than consumers of the education universities provide.

University education is on the precipice of change, and has been teetering there for some time. Postsecondary institutions are continually in a state of flux, being influenced by policy, budget, and stakeholders. Through the continued research into student approaches to learning and their relationship on teaching and learning, postsecondary institutions in Ontario can become more meaningful, practical, and satisfying places of learning for the millennial students of today.

APPENDIX A: ONLINE SURVEY

Identifying Student Approaches to Learning

{SURVEY PAGE 1}

In this survey, you will be asked to provide information about your study habits, your views on teaching and learning, and demographic information. The survey will help understand how students perceive the teaching and learning environment at UWindsor. This survey should take approximately 15-20 minutes to complete.

[Information and consent form will be inserted here online, which includes the reminder that participants may skip any questions or withdraw at any time.]

{SURVEY PAGE 2}

The Revised Study Process Questionnaire (R-SPQ-2F)

This questionnaire has a number of questions about your attitudes towards your studies and your ***usual way of studying***. There is no right way of studying. It depends on what suits your own style and the course you are studying. It is accordingly important that you answer each question as honestly as you can. If you think your answer to a question would depend on the subject being studied, give the answer that would apply to the subject(s) most important to you *(your major)*. Please choose the one most appropriate response to each question. Do not spend a long time on each item: your first reaction is probably the best one. Please answer each item. Do not worry about projecting a good image. Your answers are CONFIDENTIAL. Thank you for your cooperation!

	Never or rarely	Sometimes	Half the time	Frequently	Always or almost always
1. I find that at times studying gives me a feeling of deep personal satisfaction.	○	○	○	○	○
2. I find that I have to do enough work on a topic so that I can form my own conclusions before I am satisfied.	○	○	○	○	○

3. My aim is to pass the course while doing as little work as possible.	○	○	○	○	○
4. I only study seriously what's given out in class or in the course outlines.	○	○	○	○	○
5. I feel that virtually any topic can be highly interesting once I get into it.	○	○	○	○	○
6. I find most new topics interesting and often spend extra time trying to obtain more information about them.	○	○	○	○	○
7. I do not find my course very interesting so I keep my work to the minimum.	○	○	○	○	○
8. I learn some things by rote, going over and over them until I know them by heart even if I do not understand them.	○	○	○	○	○
9. I find that studying academic topics can at times be as exciting as a good novel or movie.	○	○	○	○	○
10. I test myself on important topics until I understand them completely.	○	○	○	○	○
11. I find I can get by in most assessments by memorizing key sections rather than trying to understand them.	○	○	○	○	○
12. I generally restrict my study to what is specifically set as I think it is unnecessary to do anything extra.	○	○	○	○	○
13. I work hard at my studies because I find the material interesting.	○	○	○	○	○
14. I spend a lot of my free time finding out more about interesting topics which have been discussed in different classes.	○	○	○	○	○

15. I find it is not helpful to study topics in depth. It confuses and wastes time, when all you need is a passing acquaintance with topics.	○	○	○	○	○
16. I believe that lecturers shouldn't expect students to spend significant amounts of time	○	○	○	○	○
17. I come to most classes with questions in mind that I want answering.	○	○	○	○	○
18. I make a point of looking at most of the suggested readings that go with the lectures.	○	○	○	○	○
19. I see no point in learning material which is not likely to be in the examination.	○	○	○	○	○
20. I find the best way to pass examinations is to try to remember answers to likely questions.	○	○	○	○	○

{SURVEY PAGE 3}

Your preferred approach to learning is a DEEP APPROACH.

Based on your responses, your preferred approach is a DEEP APPROACH.

Note that the approach to learning your answers have indicated does not define you. It is simply a reflection of your perception of your learning environment.

Your preferred approach to learning is a SURFACE APPROACH.

Based on your response, your preferred approach is a SURFACE APPROACH.

Note that the approach to learning your answers have indicated does not define you. It is simply a reflection of your perception of your learning environment.

Your Deep Approach Score is: {{(DA)}} /50

Deep Motive: {{(DS)}}/25 Deep Strategy: {{(DM)}}/25

Your Surface Approach Score is: {{(SA)}} /50

Surface Motive: {{(SM)}}/25 Surface Strategy: {{(SS)}}/25

The Characteristics of a DEEP APPROACH:	The Characteristics of a SURFACE APPROACH:
➢ **understanding comes from the experience of learning itself;** ➢ **a focus on the conceptual or underlying meaning of information;** ➢ **the act of learning is enjoyable, thought-provoking, and builds upon prior knowledge;**	➢ understanding is seen as equal to memorization; ➢ a focus on the literal meaning of course information; ➢ motives are to achieve a passing grade, an "A", or succeed in the immediate context;

The Characteristics of a DEEP APPROACH:	**The Characteristics of a SURFACE APPROACH:**
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Reflection

What **factors** might have influenced the approach to learning identified by your responses?

What does ***learning*** mean to you?

From your perspective **as a student**, how could the information from this research help make teaching and learning better at the University of Windsor?

{SURVEY PAGE 4}

Demographics

Please provide some information about yourself. Do not provide information that reveals your identity. This information will be kept confidential and will only be used for statistical interpretation.

Gender:

Age:

- ○ 17 – 18
- ○ 19 – 20
- ○ 21 – 22
- ○ 23 – 24
- ○ 25+

Year of study:

- ○ 1st Year
- ○ 4th Year
- ○ Other:

Major subject of study:

- ○ Biological Sciences
- ○ Chemistry & Biochemistry
- ○ Computer Science
- ○ Earth & Environmental Sciences
- ○ Economics
- ○ Mathematics & Statistics

- ○ Physics
- ○ Other, please specify... _____
- ○ Double major (please list two subjects): _____

Are you a full-time or part-time student?

- ○ Full-Time Student
- ○ Part-Time Student

Are you a Canadian or an international student?

- ○ Canadian student
- ○ International student

Which statement best describes your current interest in graduate studies (Masters Degree):

- ○ I have applied for a graduate program.
- ○ I am considering graduate studies in the future.
- ○ I am undecided.
- ○ I have no intention of continuing on to graduate studies.

Before this survey, had you ever heard of a Student Approach to Learning (SAL)?

- ○ Yes
- ○ No
- ○ Unsure

{SURVEY PAGE 5}

COMPLETION OF RESEARCH PARTICIPATION

Thank you for completing this survey. My hope is that by completing this survey, you might be aware of how your decisions around studying affect your university education. Below are PDF versions of your survey choices and the letter of consent you agreed at the beginning of this survey. Please print or securely save this information so you can contact the researcher regarding this study. The results of this survey are expected to be released in mid-2016 via the UWindsor Electronic Thesis Database.

APPENDIX B: LETTER OF INFORMATION FOR CONSENT TO PARTICIPATE IN RESEARCH

TITLE OF THE STUDY: **Identifying Student Approaches to Learning: Undergraduate Student Perceptions of Teaching and Learning at the University of Windsor**

You are asked to participate in a research study conducted by **Brandon Sabourin,** a graduate student from the Faculty of Education at the University of Windsor. The results of this study will contribute to Brandon's Master of Education Thesis.

This research has been cleared by the University of Windsor Research Ethics Board.

PURPOSE OF THE STUDY

The purpose of this study is to identify the ***student approaches to learning*** of undergraduate students studying in the Faculty of Science at the University of Windsor. More specifically, this research seeks to examine the approaches to learning that students are taking to their undergraduate studies as a way to understand the learning experience of students. The analysis of student approaches to learning can be useful to instructors to assess their teaching and to administration to help understand and quantify academic aspects of the student experience. A larger cross-section learning approach identification also benefits educational developers, tasked with faculty development, course design, and instructional design.

PROCEDURES

If you volunteer to participate in this study, you will be asked to complete an online survey, which will take approximately 15-20 minutes to complete. The online survey will include questions asking you to describe your study behaviour during the past academic year, your views on teaching and learning, and demographic questions. You will receive your survey results immediately, and will have an opportunity to print your results for your records.

POTENTIAL RISKS AND DISCOMFORTS

There are no known physical or psychological risks or discomforts associated with this research.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

Participants in this study will be able to reflect on their study processes, and how these comprise the approach to learning that they are taking. Those who volunteer to participate in this research might become more self-aware of their study habits, and learn more about the process of learning they are going through during their undergraduate study. They will also be adding to the collective dialogue around teaching and learning culture on their campus.

This research adds to the discussion about effective university teaching and learning, as well as the student experience. Identifying approaches to learning can be useful to instructors to assess their teaching, to educational developers to engage in instructional design, and to administration to help understand and quantify academic aspects of the student experience. In short, the research benefits students directly, and also indirectly by helping others in the academic community provide teaching and learning experiences that are most beneficial to students.

COMPENSATION FOR PARTICIPATION

There will be no compensation for participating in this research.

CONFIDENTIALITY

Confidentiality will be guaranteed to all who participate in this research. The survey questionnaire is designed to protect participant identity, so please do not enter any information that may help to identify yourself anywhere on the survey, including your name or UWin ID.

The responses collected from the online survey will be anonymous, and no unique identifying information will be collected. All data collected will be will be securely stored in a password-protected file folder on the password-protected desktop computer of the PI. All password protections will use unique passwords. The data collected from this online survey will be kept for five (5) years. After this time, the data will be destroyed.

PARTICIPATION AND WITHDRAWAL

Participants may exit the survey at any time. There will be no consequences to the participant for withdrawing from the survey. Survey participants may choose not complete any of the questions. Participants who actively withdraw (i.e., do not simply 'close' out of the browser, but select a button that cancels participation), will be removed from the dataset. Those who simply close the browser window will still have their data included in the study.

Survey participants may withdraw their data at any time before the final submission of the survey. The survey contains no identifying marks or codes, to protect the participant. This means that the researcher has no way to remove a specific participant's data after submission. After completion and submission of the survey, a participant will not be able to withdraw their data.

The investigator may withdraw you from this research if circumstances arise which warrant doing so.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE PARTICIPANTS

The primary output of this research study will be Brandon's M.Ed. thesis in mid-2016. This will include an oral defense of the thesis, which is open to the general public. The written document will be submitted to the Faculty of Graduate Studies, University of Windsor and posted in the UWindsor Electronic Thesis Database.

Web address: http://scholar.uwindsor.ca/do/search/?q=Brandon%20Sabourin&start=0&context=3419850
Date when results are available: July 2016

SUBSEQUENT USE OF DATA

These data may be used in subsequent studies, in publications and in presentations.

RIGHTS OF RESEARCH PARTICIPANTS

If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario, N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

If you have any questions or concerns about the research, please feel to contact **Brandon Sabourin at sabourib@uwindsor.ca,** or alternatively, Dr. Cam Cobb (thesis advisor) at cobbcam@uwindsor.ca or 519-253-3000 ext. 3809.

SIGNATURE OF INVESTIGATOR

These are the terms under which I will conduct research.

_____ _____

Signature of Investigator Date

SIGNATURE OF RESEARCH PARTICIPANT/LEGAL REPRESENTATIVE

I understand the information provided for the study **Identifying Student Approaches to Learning: Student Perceptions of Undergraduate Teaching and Learning** as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. By selecting **"I AGREE**" during the survey, I am consenting to have my survey response included in this research.

- ○ I AGREE to participate in this research.
- ○ I DO NOT AGREE to participate in this research.

APPENDIX C: INITIAL RECRUITMENT EMAIL

Subject Line: Participate in Research about Teaching and Learning at UWindsor by Completing this Survey!

Message:
Dear Students,

My name is Brandon Sabourin and I am a graduate student from the Faculty of Education at the University of Windsor. I invite you to participate in an online survey, designed to to identify the ***student approaches to learning*** of undergraduate students studying in the Faculty of Science at the University of Windsor. This survey is part of my M.Ed. research, and will contribute toward my M.Ed. thesis.

If you volunteer to participate in this study, you will be asked to complete an online survey, which will take approximately 20 minutes to complete. The online survey will include questions asking you to describe your study behaviour during the past academic year, your views on teaching and learning at the University of Windsor, and demographic information. You will receive the results of your survey immediately, and will have an opportunity to print your results for your records.

Your participation in this research study is voluntary. You may refuse to participate, refuse to answer any questions, or withdraw from the study with no effect. You may exit the survey at any time. Your responses will be kept confidential. There are no known risks to participating in the study.

If you have any questions or concerns about the research, please feel to contact me (**Brandon Sabourin) at sabourib@uwindsor.ca.**

This research has been cleared by the University of Windsor Research Ethics Board. If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario, N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

If you would like to find out the results of this study, my thesis will be available at http://scholar.uwindsor.ca upon completion of the project in mid-2016.

You may save or print this email for future reference. Thank you for considering participating in this study. If you are willing to complete the survey please click on the link below:

[Link to the web survey]
Sincerely,

Brandon Sabourin, Master of Education Candidate
Faculty of Education, University of Windsor
sabourib@uwindsor.ca

APPENDIX D: REMINDER EMAIL

(Sent 1 week after Initial Email)

Subject Line: REMINDER: Participate in Research about Teaching and Learning at UWindsor by Completing this Survey!

Message:

Dear Students,

I invite you to participate in an online survey, if you have not already done so. My name is Brandon Sabourin and I am a graduate student from the Faculty of Education at the University of Windsor. This survey is part of my M.Ed. research, designed to to identify the ***student approaches to learning*** of undergraduate students studying in the Faculty of Science at the University of Windsor. The results of this study will contribute toward my M.Ed. thesis.

If you volunteer to participate in this study, you will be asked to complete an online survey, which will take approximately 20 minutes to complete. The online survey will include questions asking you to describe your study behaviour during the past academic year, your views on teaching and learning at the University of Windsor, and demographic information. You will receive the results of your survey immediately, and will have an opportunity to print your results for your records.

Your participation in this research study is voluntary. You may refuse to participate, refuse to answer any questions, or withdraw from the study with no effect. You may exit the survey at any time. Your responses will be kept confidential. There are no known risks to participating in the study.

If you have any questions or concerns about the research, please feel to contact **Brandon Sabourin** at **sabourib@uwindsor.ca.**

This research has been cleared by the University of Windsor Research Ethics Board. If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario, N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

If you would like to find out the results of this study, my thesis will be available at http://scholar.uwindsor.ca upon completion of the project in mid-2016.

You may save or print this email for future reference. Thank you for considering participating in this study. If you are willing to complete the survey please click on the link below:

[Link to the web survey]

Sincerely,

Brandon Sabourin, Master of Education Candidate
Faculty of Education, University of Windsor
sabourib@uwindsor.ca

APPENDIX E: PERMISSIONS TO INCLUDE COPYRIGHTED MATERIALS

Permissions for Figure 1: Biggs' 3p Model of Teaching and Learning

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May 31, 2016

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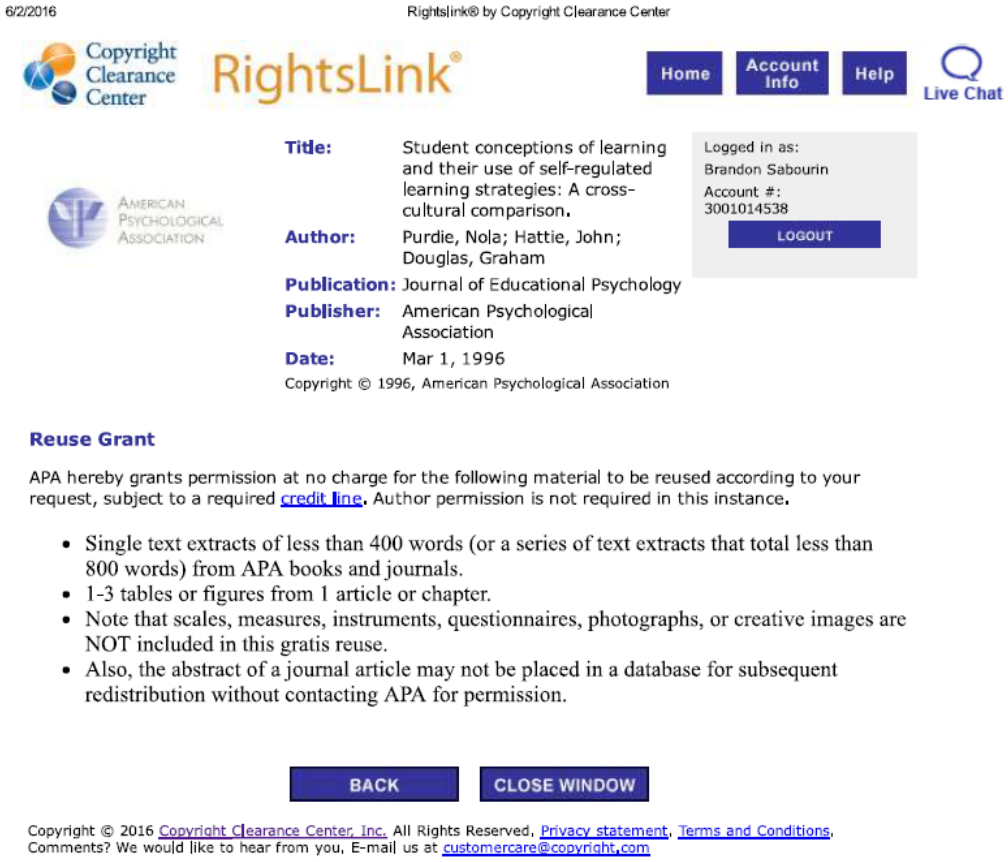

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Publication: Journal of Educational Psychology
Publisher: American Psychological Association
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APPENDIX F: DEMOGRAPHIC BREAKDOWN OF R-SPQ-2F DEEP APPROACH SCORES

Program	Gender	Year	*n*	*Mean*	*Range*	*Percentiles*	
						25%	*75%*
Biology	Male	First Year	7	26.86	21-38	21.00	32.00
		Fourth Year	7	37.14	29-45	33.00	40.00
		Total	14	32.00	21-45	25.00	38.00
	Female	First Year	5	21.00	17-28	.	.
		Fourth Year	2	41.50	40-43	.	.
		Total	7	26.86	17-43	18.00	40.00
	Total	First Year	12	24.42	17-38	19.50	27.50
		Fourth Year	9	38.11	29-45	37.00	40.00
		Total	21	30.29	17-45	24.00	38.00
Chemistry & Biochemistry	Male	First Year	2	26.50	23-30	.	.
		Fourth Year	4	24.75	24-26	.	.
		Total	6	25.33	23-30	24.00	26.00
	Female	First Year	2	24.50	22-27	.	.
		Fourth Year	5	25.40	22-32	.	.
		Total	7	25.14	22-32	22.00	27.00
	Total	First Year	4	25.50	22-30	.	.
		Fourth Year	9	25.11	22-32	24.00	25.00
		Total	13	25.23	22-32	24.00	26.00
Computer Science	Male	First Year	5	25.80	18-34	.	.
		Fourth Year	4	35.00	30-39	.	.
		Total	9	29.89	18-39	26.00	34.00
	Female	First Year	3	23.67	21-25	.	.
		Fourth Year	1	35.00	.	.	.
		Total	4	26.50	21-35	.	.
	Total	First Year	8	25.00	18-34	22.00	27.00
		Fourth Year	5	35.00	30-39	.	.
		Total	13	28.85	18-39	25.00	34.00
Earth & Environmental	Male	Fourth Year	2	40.50	39-42	.	.
		Total	2	40.50	39-42	.	.
	Female	Fourth Year	1	37.00	.	.	.
		Total	1	37.00	.	.	.
	Total	Fourth Year	3	39.33	37-42	.	.
		Total	3	39.33	37-42	.	.
General Science	Female	First Year	1	33.00	.	.	.
		Total	1	33.00	.	.	.
	Total	First Year	1	33.00	.	.	.
		Total	1	33.00	.	.	.

Math and Statistics	Male	First Year	2	28.00	27-29	.	.
		Total	2	28.00	27-29	.	.
	Female	First Year	1	17.00	.	.	.
		Fourth Year	3	35.67	32-39	.	.
		Total	4	31.00	17-39	.	.
	Total	First Year	3	24.33	17-29	.	.
		Fourth Year	3	35.67	32-39	.	.
		Total	6	30.00	17-39	27.00	36.00
Physics	Male	First Year	2	30.50	26-35	.	.
		Total	2	30.50	26-35	.	.
	Female	Fourth Year	1	32.00	.	.	.
		Total	1	32.00	.	.	.
	Total	First Year	2	30.50	26-35	.	.
		Fourth Year	1	32.00	.	.	.
		Total	3	31.00	26-35	.	.
ALL PROGRAMS	Male	First Year	18	27.03	18-38	23.00	30.00
		Fourth Year	17	34.12	24-45	29.00	39.00
		Total	35	30.49	18-45	25.00	37.00
	Female	First Year	12	22.92	17-33	18.00	26.00
		Fourth Year	13	32.38	22-43	25.00	37.00
		Total	25	27.84	17-43	22.00	33.00
	Total	First Year	30	25.40	17-38	21.00	28.00
		Fourth Year	30	33.37	22-45	26.00	39.00
		Total	60	29.38	17-45	24.00	35.50

APPENDIX G: DEMOGRAPHIC BREAKDOWN OF R-SPQ-2F SURFACE APPROACH SCORES

Program	Gender	Year	*n*	*Mean*	*Range*	*Percentiles*	
						25%	*75%*
Biology	Male	First Year	7	32.57	25-39	25.00	39.00
		Fourth Year	7	26.00	20-38	22.00	32.00
		Total	14	29.29	20-39	22.00	37.00
	Female	First Year	5	32.80	20-43	.	.
		Fourth Year	2	22.50	22-23	.	.
		Total	7	29.86	20-43	22.00	39.00
	Total	First Year	12	32.67	20-43	25.50	39.00
		Fourth Year	9	25.22	20-38	22.00	26.00
		Total	21	29.48	20-43	22.00	37.00
Chemistry & Biochemistry	Male	First Year	2	36.00	33-39	.	.
		Fourth Year	4	23.25	17-26	.	.
		Total	6	27.50	17-39	25.00	33.00
	Female	First Year	2	33.50	33-34	.	.
		Fourth Year	5	28.00	25-31	.	.
		Total	7	29.57	25-34	27.00	33.00
	Total	First Year	4	34.75	33-39	.	.
		Fourth Year	9	25.89	17-31	25.00	28.00
		Total	13	28.62	17-39	25.00	33.00
Computer Science	Male	First Year	5	32.20	19-44	.	.
		Fourth Year	4	24.00	15-27	.	.
		Total	9	28.56	15-44	25.00	30.00
	Female	First Year	3	24.67	13-40	.	.
		Fourth Year	1	26.00	.	.	.
		Total	4	25.00	13-40	.	.
	Total	First Year	8	29.38	13-44	20.00	41.50
		Fourth Year	5	24.40	15-27	.	.
		Total	13	27.46	13-44	21.00	30.00
Earth & Environmental	Male	Fourth Year	2	23.00	18-28	.	.
		Total	2	23.00	18-28	.	.
	Female	Fourth Year	1	27.00	.	.	.
		Total	1	27.00	.	.	.
	Total	Fourth Year	3	24.33	18-28	.	.
		Total	3	24.33	18-28	.	.
General Science	Female	First Year	1	26.00	.	.	.
		Total	1	26.00	.	.	.
	Total	First Year	1	26.00	.	.	.
		Total	1	26.00	.	.	.

Math and Statistics	Male	First Year	2	40.00	38-42	.	.
		Total	2	40.00	38-42	.	.
	Female	First Year	1	39.00	.	.	.
		Fourth Year	3	22.00	17-25	.	.
		Total	4	26.25	17-39	.	.
	Total	First Year	3	39.67	38-42	.	.
		Fourth Year	3	22.00	17-25	.	.
		Total	6	30.83	17-42	24.00	39.00
Physics	Male	First Year	2	23.50	18-29	.	.
		Total	2	23.50	18-29	.	.
	Female	Fourth Year	1	30.00	.	.	.
		Total	1	30.00	.	.	.
	Total	First Year	2	23.50	18-29	.	.
		Fourth Year	1	30.00	.	.	.
		Total	3	25.67	18-30	.	.
ALL PROGRAMS	Male	First Year	18	32.67	18-44	25.00	39.00
		Fourth Year	17	24.53	15-38	22.00	27.00
		Total	35	28.71	15-44	22.00	37.00
	Female	First Year	12	30.83	13-43	23.50	39.00
		Fourth Year	13	25.69	17-31	24.00	28.00
		Total	25	28.16	13-43	24.00	33.00
	Total	First Year	30	31.93	13-44	25.00	39.00
		Fourth Year	30	25.03	15-38	22.00	27.00
		Total	60	28.48	13-44	23.50	34.00

APPENDIX H: DEMOGRAPHIC BREAKDOWN OF STUDENTS' SELF-REPORTED PRIOR KNOWLEDGE OF THE STUDENT APPROACHES TO LEARNING CONCEPT

Variable	Category	Yes	Unsure	No
All Students		**1**	**16**	**43**
Gender	Male	1	25	9
	Female	0	18	7
Year of Study	First-Year	1	27	2
	Fourth-Year	0	16	14
Age	17-18	1	22	1
	19-20	0	5	1
	21-22	0	10	11
	23-24	0	6	1
	25+	0	0	2
Program	Biology	1	13	7
	Chemistry & Biochemistry	0	12	1
	Computer Science	0	8	5
	Earth & Environmental	0	1	2
	General Science	0	1	0
	Math	0	5	1
	Physics	0	3	0
Enrollment*	Full-time	1	42	15
	Part-time	0	1	1
Status*	Canadian	1	41	16
	International	0	2	0

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