2018

Supporting collaborative writing in secondary Language Arts: A revision decision method intervention

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Supporting collaborative writing in secondary Language Arts:

A revision decision method intervention

by

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Presented to the Graduate and Research Committee

of Lehigh University

in Candidacy for the Degree of

Doctor of Philosophy

in

Teaching, Learning, and Technology

Lehigh University

December 2017

Certificate of Approval

Approved and recommended for acceptance as a dissertation in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Dedication

to

Catherine Marich

1930 - 2015

Acknowledgements

Many members of the Lehigh University community have made this project possible. I would like to thank Dr. Brook Sawyer, my mentor and teacher, whose critiques, conferences, and conversations have made my dissertation process one devoted to learning about scholarship, writing, and also support. I would like to thank my other College of Education committee members, Dr. Bodzin and Dr. Hammond, for their direction and encouragement through the project's pilot, proposal, and finalization. Additionally, I would like to thank Dr. Kroll whose supportive membership in my committee provided invaluable context from the field of writing instruction. Finally, I would like to acknowledge the Lehigh University College of Education Scholarship for awarding me with financial backing during my studies.

Beyond the Lehigh community, the administrators, faculty members, and students of the school district I worked with have also contributed essential opportunities for which I am grateful. In particular, I would like to thank Katie Beers for assisting with the dissertation's pilot project; upon that foundation, the dissertation could raise its roof.

Closest to home and heart, I would like to thank my family. I would not have been able to complete or believe in this project without your motivation and understanding. Oliver and Joanna, I hope that I have already started keeping my promises and devoting to you the faithful support you pledged and gave to me.

Any omission on my part in this acknowledgement may signify how naturally your fresh coffee or patient inquiries contributed to my progress. I intend to thank you by offering the same to others who persist in learning.

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Abstract

Much of the research on digital collaborative writing focuses on undergraduate and graduate writers, yet under-studied high school students also need 21st century literacies for academic and workplace success. To meet this need, educators require interventions supporting high school students' collaborative writing skills development. A substantial body of research has established the efficacy of scripting during digital collaborative tasks. Yet less is known about the effect of digital collaborative writing scripts upon high school students. In this quasi-experimental study, one high school Language Arts class engaged in a revision decision method intervention script for collaborative writing. This treatment group was compared with students writing collaboratively with a business-as-usual control approach. Using a mixed methods design, this study investigated and found that the revision decision method increased the treatment group students' revision depth, but that it did not affect their metacognitive regulation, and ownership feelings.   Self-generated scripts used by high school students under the control condition represented a more cooperative approach to collaborative writing that was dominated by superficial revision targets. Implications include that scaffolding high school collaborative writers may benefit from providing metalanguage for reflection, as well as the possibility that high school collaborative writing might promote success at peer review processes that transfer to other writing modes. The study's strengths and weaknesses in overall design may help to provide additional direction in future research on strategies to support high school collaborative writers' success.

CHAPTER 1: INTRODUCTION

21st Century Digital Literacy

The 21st century literacy standards outlined by the National Council of Teachers of English include building collaborative relationships that design and share purposeful information in a way that requires individuals to integrate real-time input (2008). In their discussion of how to achieve digital literacy, Hicks and Hawley Turner (2013) observed that it took decades for classroom practices to respond to cognitive theories identifying writing processes, not written manuscripts, as a primary focus for effective writing instruction. The rate of that response is troubling given more recent changes impacting the relationship between digital collaboration platforms and writing that potentially address NCTE expectations. Consider that from 2012 to 2015, users of Google Education's novice-friendly applications suite have grown in number from 8,000,000 to 45,000,000 (Alhadeff, 2015). In such low-overhead and widely adopted collaborative workspaces, the next frontier of writing instruction awaits. Despite the expectation and opportunity to prepare students for digital collaborative writing, though, effective pedagogical strategies to promote collaborative writing in a digital environment remain relatively undefined for high school educators.

In higher education, however, first year composition reform movements have shown some response to changes in digital collaborative writing. For first-year composition students, the Council of Writing Program Administrators has identified a desired outcome to simply "experience the collaborative and social aspects of the writing process" (2014). Still, this directive remains open to institutional interpretation. Conceivably, a student who asks a peer to check a finalized printed manuscript for typos has met the expectation as well as students who

have co-authored an experimental study in a Google Docs environment. However, from efforts by researchers and practitioners to promote a more transfer-oriented outcome for first-year composition students, collaborative writing has emerged as an increasingly viable platform to achieve this broader reform goal (Wardle, 2007). So, secondary education may be gravitating to some pursuit of consensus to incorporate digital collaborative writing into first-year composition courses.

The issue of digital literacy is also compelling for high school graduates who enter the workforce directly without higher education experiences. Workplace-bound graduates are also expected to collaborate as effective members of a team, according to the Partnership for 21st Century Learning (2013). As the field stands, teachers are unprepared to provide an organized response to the unilateral demand for such skills. More importantly, today's high school students cannot wait decades for the field of writing instruction and digital literacy to catch up to emergent technologies and expectations. As a result, high school teachers must be equipped to help high school students head to higher education and the workforce equipped with digital collaborative writing skills that support broader digital literacies.

Empirical studies must guide educators on how to teach students to write collaboratively. And, unlike the trend in higher education, no parallel, tangential attention on high school writing instruction is occurring that might lead to incidental promotion of 21st century literacies in collaborative writing (Graham & Perin, 2007). In fact, a wave of studies targeting the digital collaborative writing experiences of higher education students using today's dominant technologies (e.g., Andraesen, Winther, Hanghøj, & Larsen, 2014; Bremner, Peirson-Smith, Jones, & Bhatia, 2014; Brodahl, Hadjerrouit, & Hansen, 2011; Caspi & Blau, 2011; Daemmrich, 2010; Limbu & Markauskaite, 2014) has yet to be met by similar attention to high school

students.

21st Century Digital Literacy through Collaborative Writing

Defining and expecting collaboration. Workplace and higher education collaborative writing expectations and demands exist (Lardinois, 2012; Rao, 2011) and extend into today's information economy (Rice, 2009), and our students must develop the skills to meet those expectations and demands. Additionally, collaborative writing promotes deeper learning in a way that makes it valuable beyond just meeting demands and expectations beyond high school. Since any writing is fundamentally a process, not a product (Flower & Hayes, 1981; Greene & Azevedo, 2007; Scardamalia & Bereiter, 1983), collaborative writing is an increasingly iterative process of construction, not a constructed product. When writing, collaborative learners can engage in interdependent (Southavilay, Yacef, & Calvo, 2009), elaborative (Butler, Godbole, & Marsh, 2013) learning activity.

Further, the deeper learning activity involved in collaborative writing forms a process that is challenging and may always feel like "learning." Writing proficiency requires an individual to orchestrate multiple processes, unachievable without applying conditional knowledge (Braaksma, Rijlaarsdam, & Van den Bergh, & Van Hout-Walters, 2004). As a writer considers content or stylistic decisions, cascading effects of organizational or wording options require complex hypothetical consideration and evaluation. Some of such knowledge creation activity engaged in by learners can be managed through metacognition (Pifarré & Cobos, 2009; Scardamalia & Bereiter, 2006).

Since collaborative writing includes both independent and shared tasks (Barile & Durso, 2002; Ede & Lunsford, 1990), metacognition during collaborative writing includes self-regulation directed at a writer's own writing, co-regulation directed as other writers' writing, and

shared regulation directed at the actual collaborative writing (Chan, 2012; Garrison & Akyol, 2015). When adding the complexity of contributions, suggestions, or actions of concurrent writers, prioritizing emergent and unpredictable options increases the cognitive load of learners. With this in mind, the perspective of De Milliano, Van Gelderen, and Sleegers (2012) that collaborative writers, regardless of experience even, may function at a novice level seems worth additional consideration. In their evaluation of collaborative writing, the researchers noted that the unique demands of collaborative writing processes can exceed a learner's self-regulation strategies, thus limiting the sense of mastery. With so many interdependent, elaborative iterations co-occurring during collaborative writing, individuals may encounter immediate and complex problems that exceed their normal writing process strategies.

This desirable state of constructive conflict (Wolfe, 1990) meshes, however, with constructivist principles emphasizing the need for learners to actively construct knowledge from a state of cognitive dissonance (Jonassen & Land, 2012). Such a state permits learners to build knowledge rather than tell or receive knowledge (Beach & Doerr-Stevens, 2009) in order to achieve cognitive growth and effortful learning (Clark, D'Angelo, & Menekse, 2009).   What makes digital collaborative writing challenging is also what makes it rewarding for learners.

Although they may be opportunities for learning, challenges of collaborative writing include managing coupled and decoupled activities, limiting counter-collaborative feelings of ownership, managing iterative feedback, and controlling cooperation tendencies.

Managing coupled and decoupled activities. Certainly its range and dynamic of activities contributes to collaborative writing's challenging nature**.** When writing collaboratively, individuals may not work together to consider every word, sentence, or decision that becomes part of the writing process. To do so would also seem impractical for both higher education and

workforce collaborative writers. Barile & Durso (2002) found that a higher volume of individual writing tasks compared to consensus-building writing tasks occur during digital collaborative writing. Shifting between independent and shared tasks may help to manage the increased demands of collaborative writing, but then even those strategies to regulate shifts introduce additional demands for learners to manage.

Researchers have identified collaborative writing patterns that do accommodate the distribution of individual and shared tasks (Mayordomo & Onrubia, 2015). Although their work related to the manipulation of data during collaborative visual explorations, McGrath et al. (2012) referred to the helpful branching and merging of individual and shared tasks, as well as the coupling and decoupling of tasks, during collaborative work sessions. A "shared" task involves simultaneous and joint effort, as opposed to "individual" tasks performed at varying times and without the observation and audience awareness that would occur when working in the same space at the same time. Different from such independent tasks, "decoupled" tasks occur, yet also remain part of a writer's awareness within the context of coupled tasks. When a writer expects to couple with other writers again as part of the writing process, decoupled activities remain related to the context of that broader writing process. The transitions from collaborative writing's independent to shared tasks can generate cognitive demands of planned and spontaneous interaction. With that in mind, this study will refer to consensus-building tasks, such as active revision of text, as coupled and independent tasks, such as solo drafting of text, as decoupled.

Another benefit of distributed cognitive aspects of collaborative writing is how knowledge resides in the texts of others (Stahl, 2006), but making use of that opportunity relies upon metacognition. By working under coupled and decoupled conditions for text production,

learners gain the opportunities necessary in order to develop and process conceptual changes (Nussbaum, 2012). By transitioning between decoupled independent tasks, to coupled shared tasks, learners have the opportunity to process their learning. During these transitions, metacognitive processes necessary to negotiate between internal messages and competing concepts (Anderson et al., 2001) are also boosted. Without these transitions and process opportunities, less regulation occurs, as a learner does not perceive or act as though a new iteration, with new learning, has been produced. The learning opportunities that occur during writing become expressed overtly and gain more prominence during collaborative writing.

Limiting counter-collaborative feelings of ownership. Ownership awareness can make individuals uncomfortable when suggesting changes to another person's writing (Wolfe, 1990). Instead of taking ownership of the collaborative writing process, writers may remain focused on individual ownership of a written manuscript (Ede & Lunsford, 1990). Writers may shift from feeling ownership over their own writing to feeling ownership over shared writing. Sensing others' feelings of ownership shifting may also occur as shared ownership develops. Without such shifts, the delicate relationship between the unique challenges and benefits of collaborative writing is undermined.

Closely tied to the manuscript itself, ownership may sometimes be connected to a writer's sense of having a unique voice (Elbow, 1981) comprised of individually manipulated stylistic components (Lane, 1998). The recently updated NCTE Professional Knowledge about the Teaching of Writing (2016) included observations about writing and the writing process as vehicles for more introspective and affective personal change, and the role of educators to encourage this intimate, personal relationship between students and their writing. What makes writing a powerful force of identification, though, can become obstructive to the collaborative

writing process and also requires management.

Managing iterative feedback. Other areas of technology-enhanced education growth
have had more time to advance and refine the use of real-time collaborative workspaces. Mobile
learning, for example, has developed to build on the affordances of synchronous learning
experiences for collaborators. Of particular interest to collaborative writing in real-time revision
and editing workspaces, mobile learning has boosted iterative feedback loops between learners
with its scaffolding of real communication, data management, and manipulation (Klopfer, 2008).
Instead of considering that flow of information as only adding challenge to tasks, mobile
learning features capitalize on how much easier it is for learners to receive feedback on-the-fly.
These features are somewhat replicated by the real-time revision and editing user interfaces in
today's collaborative documents (Perry & Morphett, 2015). Further, these features mean that
coupled and decoupled tasks can co-occur with greater variation than approaches appropriate for
a business-as-usual edit-turn approach. In a sense, the practice of trading text back-and-forth
becomes intensified into tighter exchanges with increasing rapidity, making iteration more
possible and beneficially looped. Writers can work side-by-side without excessive lagtime
between iterations. This accounts for some of collaborative writing's challenges, yet it also
suggests the feedback during the collaborative writing process may hold learning potential that
justifies the demands it makes on writers.

Controlling cooperation tendencies. Due to the increasing demands that include shifts
between coupled and decoupled activities, shifting feelings of ownership, and managing iterative
feedback, collaborative writers may revert to cooperation more than collaboration. Collaboration
is distinct from cooperation during writing, yet cooperation can easily be confused with
collaborative writing. Cooperation may be limited to presenting relatively fixed or superficial

knowledge (Butler et al., 2013; Paulson, Anderson, & Armstrong, 2007) without requiring active evaluation of choices (Jonassen & Land, 2012). Writers' tendencies to self-select relatively superficial targets for revision with a peer is a known concern (Paulson et al., 2007) that persists even in computer supported collaborative learning environments (DeWever, Hämäläinen, Voet, & Gielen, 2015; Lin & Reigeluth, 2016). Accordingly, business-as-usual, turn-taking peer review often included in the writing process is more cooperative than collaborative (Lowry, Curtis, & Lowry, 2003). Collaborative writing focuses learners on processes more than products, and it requires a shift from such business-as-usual approaches.

Scripting for Collaborative Writing Support

When writing collaboratively, choices emerge about both the written manuscript and writing process. Learners need assistance to sustain collaboration to avoid responding to cognitive loads by compressing choices to a less beneficial state of cooperation instead. Brown et al. (1993) emphasized the importance of ritual in effective classroom climates, noting how a set repertoire of activities reduced stress and loss of learning by enabling students to play distinct roles within a collective system. In a computer supported collaborative learning environment, scaffolding the processes required of collaborative learners through scripts has become a baseline approach (Stahl, 2006). In particular, early structuring, monitoring, modeling, coaching and contributing during learning by teachers supports digital collaborative learning by scaffolding learner progress (Resta & Laferrière, 2007). A degree of well-intentioned structure and definition through scripting can encourage collaboration and control cooperation tendencies, maximize the benefits of iterative feedback, overcome the inhibitory feelings of ownership, and manage the network of coupled and decoupled acts.

Scripting for the unique demands of writing. The distinct nature of writing as a

learning mode and process further justifies scaffolding the process by scripting digital

collaborative writing. When laying out the considerations of scripting a different learning mode,

game-based learning, Squire (2006) posited a critical scripting dichotomy by describing how

designers choose between presenting a learner with a puzzle, or engaging learners with a

problem. Within this conceptualization, Squire's puzzle contains a set path with relatively

predetermined steps that only provide success through a designed, designated sequence.

Deviations correct a learner's course, with options often simulating the cognitive sensation of

choice to a low level. This may feel like an iterative loop, but it truly follows more of a process

of elimination. For instance, and put into a writing context, if a learner has three choices of a

word (their, there, and they're), a learner may quickly find the right, and only, answer without

understanding anything more than it being the only choice that lead to task completion. A more

ideal learning task should instead present the learner with a problem that requires expertise

through active negotiation of dissonance and consideration of alternatives. Providing some

degree of elaborative feedback can problematize even a conventional, rule-driven decision

regarding a manuscript, turning it into more of a problem than puzzle. With a problem, multiple

paths lead to success, but they require more substantial cognitive engagement from the learner.

The more effortful the manipulation of facts and content, the more transferable learning becomes

(Wiley & Voss, 1999) to maximize the enduring individual benefits of collaborative gains.

Collaborative writing can reach a level of productive interdependence without becoming

too much of a puzzle or a problem. By developing and adopting roles in a more simplified

workspace (Bransford & Schwartz, 1999), the kind of indeterminacy that may overload working

memory (Bruning, Schraw, & Norby, 2011) is controlled. Meaning, a more focused set of

options can keep a writer from encountering too many iterations during collaboration. This

presents a more appropriate level of categorical choices that are manageable and even open to sequencing. For example, if composing a lab report, taking on the role of checking for discipline-specific vocabulary presents a writer with a completely different role than structuring content according to chronology. Alternatively, those same tasks can be performed by collaborative writers working in parallel on distinct portions of a manuscript. Scripting provides a way to design and sequence the guided practice support learners and, more specifically, collaborative writers need.

A Revision Decision Method for Digital Collaborative Writing

In order to help prepare teachers to equip students for necessary, effective, and beneficial digital collaborative writing, this study assessed the utility and effects of a specific form of scripting for digital collaborative writing, namely the revision decision method. This study investigated this revision decision method in order to start the process of providing high school educators with flexible, manageable, and scalable intervention strategies. The revision decision method used in the study is an attempt to curtail students' tendencies to cooperate superficially rather than collaborate deeply when writing. The revision decision method scripted roles within coupled and decoupled activities that encourage iterative feedback.

Revision decision method benefits. The supportive scaffolding of a revision decision method should have assisted learners seeking to manage writing objectives, metacognition, and ownership in order to develop as capable digital collaborative writers.

Deepening revision targets. Since business-as-usual peer review has been found to promote emphasis of superficial writing product features (Paulson et al., 2007), the study's revision decision method was designed to target deeper writing product objectives, as well as expand the collaborative writers' objectives to include writing process objectives. This occurs,

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in part, if the desired effect of overcoming feelings of ownership that have been found to inhibit meaningful revision in collaborative writing (Caspi & Blau, 2011) also occurs. By targeting and revising traits of voice, ideas, sentence fluency, and word choice instead of conventions, organization, and presentation, more meaningful and deeper product objectives should gain attention. Process objectives would also deepen, in part, if metacognition includes both self- and co-regulation, along with shared regulation. By coupling the revision sub-process of a full writing process across the collaborative writing group rather than treating it as a decoupled task, desirable attention to the collaborative writing process may have also occurred (Ens, Boyd, Matczuk, & Nickerson, 2011).

Encouraging metacognition. Although the purpose of a script during collaborative writing is to absorb some of the cognitive load, metacognition during collaborative writing can both drive and report upon a learner's engagement with the collaborative writing process. As a result, the effect of a scripted revision decision method upon metacognition during collaborative writing should be evident through its effect on both self-regulation, co-regulation strategies, and shared regulation. (Volet, Summers, & Thurman, 2009).

Overcoming feelings of ownership. Collaborative writing with a scripted revision decision method may have also affected a writer's sense of ownership. Researchers have at times, specifically uncovered an individual's reluctance to have an impact upon another person's written work (Brodahl et al., 2011; Caspi & Blau, 2011; Sadauskas, Byrne, & Atkinson, 2013) and, resultantly, confirmed that collective ownership must be pursued (Lin & Reigelth, 2016) with shared goals (Lowry et al., 2003). To make collective ownership develop, this study's revision decision method will script the process writers use when communicating about progress from decoupled to coupled writing tasks.

Statement of Purpose

This study aimed to begin the process of examining a method to teach high school students a scripted method for engaging in one aspect of collaborative writing, shared revision of drafted text. The study had both primary and secondary aims. The primary aim was to see whether or not using this scripted process promoted desired outcomes during collaborative writing by managing its challenges. Within this aim, the study also considered how high school students felt about using this process when writing collaboratively. The secondary aim was to identify any authentic practices high school students used to engage in digital collaborative writing. The study sought to expand the progress already made in building a knowledge base about collaborative writing from the efforts of teams working with older populations and varying methodologies.

Research Questions

This study followed a quasi-experimental mixed methods design. In this study, the treatment group received and used the revision decision method scripting when completing collaborative writing assignments. A revision decision method was scripted and evaluated for effects of deepening participants' targeting of writing objectives, enhancing metacognition for both self- and co-regulation, and addressing the inhibitory feelings of ownership that can occur during collaborative writing. A business-as-usual control group received collaborative writing assignments without scripting through the revision decision method.

The study's primary aim was to understand the effects of a revision decision method intervention for high school students' collaborative writing by investigating the following questions:

1. What are the effects of a scripted revision decision method on the depth of writing

objectives? That is, do students who participate in the treatment condition (i.e., scripted condition) have a different and/or deeper revision targets compared to the students who participate in the control condition?

2. What are the effects of a scripted revision decision method on metacognition? That is, do students who participate in the treatment condition (i.e., scripted condition) have higher reported levels of metacognition compared to the students who participate in the control condition?

3. What are the effects of a scripted revision decision method on feelings of ownership?

4. What are treatment students' perceptions of the feasibility and satisfaction of the revision decision method intervention?

I hypothesized that engaging in collaborative writing with a scripted revision decision method would deepen revision targets, enhance metacognition for self- and co-regulation, and both lessen non-collaborative feelings of ownership and shift ownership to the collaborative writing process. Conversely, I hypothesized that high school students in the control condition would target more superficial revision objectives, report lower levels of metacognitive self- and co-regulation, and report more consideration of feelings of ownership affecting collaborative writing.

Second, the study's secondary aim was to identify authentic practices regarding aspects of digital collaborative writing by investigating the following question:

5. What self-generated scripts or strategies, if any, for revision decision-making during digital collaborative writing do high school students in the control condition use?

My hypothesis for this second aim was based upon both literature review and the pilot study associated with this study. I hypothesized that any self-generated scripts or strategies used

by high school students in the control condition would reflect more cooperative writing patterns than collaborative patterns.

Significance of the Study

This study sought to begin the process of extending initiatives to prepare high school students for the 21st century literacy demands of digital collaborative writing.

This study aimed to provide educators with an adaptable and scalable intervention in the form of a revision decision method. In doing so, the study sought to support an under-studied group, high school students, to learn how to write collaboratively in order to meet 21st century literary demands either workplace readiness or higher education.

This study also employed various methodologies. Current digital collaborative writing studies often used interviews of undergraduates (Limbu & Markauskaite, 2014) and academics (Kim & Eklundh, 2001). Some undergraduate studies (Caspi & Blau, 2011) have included intervention components. This study incorporated both interview and intervention components in order to provide a more informed view of digital collaborative writing by high school students.

Secondly, other studies, especially on the graduate and postdoctoral level, have relied upon self-reported sources of data. Self-reported experiences when writing full-length books collaboratively (Boellstorf, Nardi, Pearce, & Taylor, 2013), articles (Ens et al., 2011), and single publications (Perry & Morphett, 2015) have provided anecdotal evidence from individuals who tend to bear the kinds of motivation and expertise beyond the scope of high school students, making it harder to generalize their experiences to that under-studied age group. This study encouraged self-reporting during focus group interviews from its high school participants.

Additionally, some stealthier forms of data gathering to examine collaborative writing have been applied to research efforts. Viégas, Wattenberg, and Dave (2004) visualized history

flows of collaborative Wikipedia pages to consider patterns in writing dynamics. Wang, Olson, Zhang, Nguyen, and Olson (2015) have used a visualization of collaborative documents to search for patterns of use by collaborative writers on the undergraduate level. This study attempted to provide a more fully dimensional view of the collaborative writing experiences of high school writers by using visualizations of documents in comparison with the content of threaded commentary, textual revisions, and self-reported experiences during interviews.

By extending the knowledge base, and applying a range of available methodologies to an under-studied population, the study sought to evaluate the effects of scripting a focused portion of the collaborative writing method in a quasi-experimental study with a stronger foundation and focus.

CHAPTER 2: REVIEW OF THE LITERATURE

Digital Collaborative Writing

When presenting a comprehensive view of collaborative writing's many variations, Lowry et al. (2003) offered a compact definition of collaborative writing that illustrates some of the components that characterize it: "Collaborative writing is an iterative and social process that involves a team focused on a common objective that negotiates, coordinates, and communicates during the creation of a common document" (p. 12). To appreciate the implications of this definition, several concepts require consideration. First, however, a fundamental difference between collaborative and cooperative writing must be addressed. Theoretical implications of distributed cognition also put these salient features of collaborative writing into context as a learning process. Additional theoretical framework concepts from situated cognition, sociocognitive, and sociocultural theories also must be acknowledged.

Next, this chapter will further define and elaborate upon critical components of collaborative writing raised directly by Lowry et al.'s definition: the nature of iterative and social processes; the focus upon common writing objectives; and the way a team functions through negotiation, coordination, and communication in the workspace of a common document. Within those critical components, metacognition, ownership, writing objectives, and the role of scripting collaborative writing will also be further elaborated upon. In particular, scripting's ability to address the above collaborative writing components will be explored. Finally, the study's revision decision method incorporating all of these concerns will be elaborated upon more fully.

Collaborative versus Cooperative Writing

Understanding collaborative writing begins with contrasting collaborative writing with

cooperative writing. Collaboration is the active construction of building understanding without necessarily reaching consensus (Goos, Galbraith, & Renshaw, 2002), as opposed to cooperation during writing. Collaboration includes effortful accomplishment since no individual learner is automatically or quickly over and done with a task that, by definition, includes meaningful peer interaction. The efficacy of collaboration benefits, even without consensus, have been validated by at least one study where collaborative success correlated with the discourse process of learners more than the quality of the final product (Perera, Kay, Koprinska, Yacef, & Zaiane, 2009). When meaningful peer interaction occurs, learning becomes reciprocal in that individuals deliver and receive learning opportunities to and from each other.

In contrast, cooperation may be limited to presenting relatively fixed or superficial knowledge (Butler et al., 2013; Paulson et al., 2007) without requiring active evaluation of choices (Jonassen & Land, 2012). When cooperation occurs, learners may deliver learning opportunities without necessarily receiving others' incoming learning opportunities, thus, muting the benefits of peer interaction (Limbu & Markauskaite, 2014). Although cooperative writing aligns more closely to task performance and may be a desirable experience at times, collaboration presents as more of a learning experience geared towards beneficial knowledge building (Evans & Bunting, 2012).

Theoretical Framework

One of the most significant differences between cooperative and collaborative writing, then, relates to how independent and shared activities are negotiated within the writing process. Collaborative writing involves discrete coupled and decoupled, or independent and shared, processes (McGrath et al., 2012; Yarrow & Topping, 2001). An approach to these parallel processes permits understanding of both individual cognition, as well as the interactions between

individuals. This study's perspective on the cognition experienced individually as well as among

and between fellow collaborators is informed by distributed cognition theory and elaborated

upon in the section that follows. This theoretical context is complemented by the community of

practice model offered by situated cognition theory, a sociocognitive approach considering

individual processes, and a sociocultural approach considering interactions, since these

additional theories support gaining insight into collaborative writing without excluding either set

of processes.

     Distributed cognition and digital collaborative writing. The ability to understand the

coupled and decoupled processes in collaborative writing expands with adoption of a distributed

cognition theoretical framework. A distributed cognition perspective emphasizes the interplay

within and between individuals, and their learning tools and spaces. According to Ligorio,

Cesareni, and Schwartz (2008), social dimensions, artifacts, and environmental structures are all

parts of an intelligent network of learning process components that distributed cognition

considers. The increased cognitive demands of writing identified by distributed cognition theory

highlight how memory loads may be supported across this intelligent network. Having a pencil,

paper, and written text to hold portions of the writing process aids a learner's cognitive resources

to attend to other social dimensions, artifacts, and environmental structures that become part of a

writing process.

     In a digital environment, the responsiveness of the environmental structures provide

additional network components to both manage and increase memory loads. In a real-time

revision and editing collaborative writing setting, every collaborative writer provides additional

social dimension to the writing team. A blinking cursor can function as a cognitive component

by providing a reminder of the interplay between writing partners' activities and individual

writers' writing activity. Awareness of this interplay has been reported to extend to independent

writing due to how a writer becomes aware of parallel, unseen writing activity by partners in the

same document (Boellstorff, Nardi, Pearce, & Taylor, 2013). Such components all play an

active, necessary, and reactive role in the cognition experienced by the individual writer. Within

this theoretical context, writers, writing, and the writing space itself all become part of a

cognition network.

       Considering the validity of an individual writer. Knowing that collaborative writing

involves a combination of independent writing processes and shared processes (McGrath et al.,

2012; Yarrow & Topping, 2001), and the tendency of individual writers to remain aware of

writing partners as described above, considering how genuinely independent decoupled writing

tasks are during collaborative writing is aided by a distributed cognition perspective. Distributed

cognition theorists actually disagree over whether or not individual cognition aided by

technology occurs as a discrete process. Salomon, Perkins, and Globerson (1991) contended that

based partly upon cognitive residue, or learning, resulting from individual technology use, solo

performance does remains distinguishable. In this view, since individuals show knowledge or

skill gains measurable after using technology, their cognition may remain distinct from the tool

in future performance. Dieterle, Dede, and Schrier (2007) explained this kind of effect of

technology in terms of the fundamental cognitive reorganizations that it can provoke. Those

cognitive reorganizations are also individual and independent.   Yet, a more radical view posited

by Pea (1993) challenged that no intelligence is genuinely possessed; intelligence only exists

when accomplished. Accomplished intelligence must appear in a learning artifact. In a way,

writing, then, is an artifact that captures and manipulates some of the writer's cognition. From

Pea's perspective here, even the individual has permanently left some cognition within the

writing artifact and does not possess it without that artifact's existence.

More aligned with the way this study defines digital collaborative writing, Perkins (1993) advocated a person-plus definition of distributed cognition. In the person-plus model, the individual retains the cognitive core in a joint cognitive system, regardless of whether or not technology forms part of the system. When working as an individual during phases of collaborative writing, there will still be independent processes experienced by writers. From this perspective, this study can view decoupled processes as experienced by an individual, and coupled processes as experienced by the collaborative writers. However, given the comprehensive views provided by distributed cognition theory, the study also recognizes that individuals still experience awareness that can certainly be interactive during others' decoupled acts, and coupled acts become part of decoupled actions, too. Independent writing processes conducted in the context of collaborative writing do include effects of coupled processes.

Reconsidering the process versus product divide in writing. Writing is often considered as a product. This study considers writing as a processed experience. As much as this study maintains this focus on writing as a process not a product, these distributed cognition theories posit that the manuscript of written text functions as a processed experience for writers. From a distributed cognition perspective, writing is recognized as a learning artifact that promotes and accomplishes intelligence (Ligorio et al., 2008). One of the benefits of a distributed cognition view of collaborative writing is the reminder of how knowledge resides in the texts of others (Stahl, 2006) through observations. In a collaborative writing environment with real-time revision and editing dynamics, individual writers also have access to the live-action writing of others. This is not the same experience as receiving and reading an updated version of a draft from a writing partner, as would occur with an edit-turn scenario of collaborative writing. From

a distributed cognition perspective, real-time revision and editing collaborative writing provides a distinct learning opportunity related to the learning mode and tool of writing. Pea (1993) argued that learners suffer from the ubiquity of language and, due to their continued exposure, do not always experience the intelligence-bearing process that language provides. If so, the learning benefits of another's static text may be limited. Witnessing the processing of language by writing partners may reinvigorate an individual's ability to engage with the value of a manuscript and make more active use of the learning potential of what others have contributed to the collective manuscript.

From a distributed cognition perspective, learners' experiences with written text through the enhanced visual interfaces with text can re-emphasize the cognitive role of written language. Today's collaborative workspace designs make engaging in text composition and physical partner awareness intuitive and responsively dynamic through features such as simultaneous editing by multiple users, and internal threaded comments (Brodahl et al., 2011). Research has shown that students benefit from visual stimuli, such as videos of collaborative work sessions (Craig, Chi, & VanLehn, 2009), watching themselves immersed in learning experiences (Dede, 2009), and viewing the contributions of others (Näykki & Järvelä, 2008). Today's collaborative workspaces provide users with choice and control over beneficial visual stimuli integrated into written text as part of the writing process.

Complementary theoretical frameworks. Other theoretical frameworks are also helpful when placing collaborative writing into context. The community of practice approach from situated cognition theory, sociocognitive theory, and sociocultural theory all provide insight regarding the processes involved in collaborative writing.

A community of practice with workplace features. Situated cognition's theoretical

context for collaborative writing is also worth considering, especially the dominant community of practice model (Schoor, Narciss, & Körndle, 2015). As Shaffer explained (2006), one of the primary research aims of situated cognition has been to study groups that develop based around applying similar approaches to solving similar problems. Situated cognition theory considers such groups, often formed within professions such as military organizations or labor unions, to become communities of practice. Shaffer also explained how in a community of practice, expert performances become public processes used by novices or coping learners to observe and treat as additional learning artifacts.

Distributed cognition theory accepts a related principle that learning is not truly seen, but that learning in groups is more easily visible, an advantage for researchers especially (Stahl, 2006). Accordingly, when an individual learner performs a segment of a learning task, that learner shares access to the distributed performance pool of other learners, not just researchers. In collaborative writing, interaction between others and their learning performances in terms of quantity indicates effortful learning (Breslow et al., 2013). To ensure a quantity of interaction between collaborative writers, task distribution of writing processes can make collaboration occur, as well as enhance task engagement (Klopfer & Squire, 2008). Part of the task includes remaining aware and observant of what other writers do, even when tasks may appear more decoupled. In terms of workspaces, real-time revision and editing in a collaborative document affords this community of practice dynamic to occur (Evans & Bunting, 2012) since many decoupled tasks remain accessible to other writers.

Situated learning theory also suggests a critical component of timing in adopting new knowledge and skills. The ability of a community of practice to offer more flexibility, distributing knowledge and skill on an immediacy of needs basis, has proven advantageous to

interaction when writing. Noroozi et al. (2012) determined that just-in-time information

presentation during personal and online discussions outweighed benefits of advance-distribution

of information. Real-time collaborative writing revision and editing would promote just-in-time

information access. McKenney and Reeves (2013) referred to the advantageous gaming

transformation of learners into players with intentionality, legitimate content, and consequential

context based upon the factor of timing. In a way, writers need to transform into collaborative

writers. Those same behaviors, if encouraged by timing, could support such a shift. As a result,

similarities in approach to similar problems might emerge and encourage a true community of

practice approach within a collaborative writing group.

> ***Sociocognitive and sociocultural theoretical support.*** According to both sociocognitive

and sociocultural theories, collaboration benefits individual learners. Distributed cognition

theorists have asserted that collaborative tasks produce shared knowledge and expertise (Perkins,

1993), and yield accomplished intelligence surpassing solo capacity (Pea, 2003). Sociocognitive

theorists have agreed that collaborative tasks support knowledge-building results (Beach &

Doerr-Stevens, 2009), and permit learner interpretation and participation (Gee & Hayes, 2011).

Social constructivist theory has identified collaboration as a means to progress from actual to

potential performance (Vygotsky, 1978), present learners with authentic, real-world complexities

(Bonk & Cunningham, 1998), and promote knowledge as a process through discourse (Jones &

Brader-Araje, 2002). Thus, grounded by principles of sociocognitive and sociocultural theory,

collaborative writing provides opportunities for individuals seeking to develop as writers and

learners (Lave & Wenger, 1991).

> **Theoretical summary.** Thus, multiple theoretical frameworks acknowledge that digital

collaborative writing engages learners in participatory ways with themselves, their writing, and

other learners (Gee, 2004; Gee & Hayes, 2011). From the primary theoretical basis of this study, a distributed cognition framework, participation with the present and responsive text, text workspace, self, and others is validated by how access to and the motion of information trumps the locus of information (Perkins, 1993). This invites learners not to finish a puzzle, but to process a problematized task of complexity with richer, varied, and distributed cognitive components.

Defining Collaborative Writing and Its Components

The definition of collaborative writing from Lowry et al. (2003) provides a helpful consolidated view of its dynamic components and processes: "Collaborative writing is an iterative and social process that involves a team focused on a common objective that negotiates, coordinates, and communicates during the creation of a common document" (p. 12). To appreciate the implications of this definition, several concepts require consideration: the nature of iterative processes; the factor of social processes; the focus upon common writing objectives; and the way a team functions through negotiation, coordination, and communication in the workspace of a common document.

Iterative processes through metacognition. An effective iterative process repeats but more importantly changes over the course of repetition to indicate learning through active participation in those changes. During iterative processes, effective learners monitor and regulate learning through metacognition (Brown, 1987). As iterations occur, the high demands of metacognitive monitoring may cause some learners to resort to simpler cognitive monitoring without reflection (Greene & Azevedo, 2007), but that would limit a learner's performance, as well as long-term metacognitive growth since such skills build with time and effort. In the context of collaborative writing in a wiki environment, Hmelo-Silver and Barrows (2008) did

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find a correlation with metacognitive comments and successful knowledge building, suggesting that supporting collaborative writing, and especially the iterative processes required to pursue it, demands an understanding of individual metacognition.

The metacognitive components that support effective iteration draw from two established frameworks. Flavell (1979) considered metacognition to include four components: a) knowledge that encapsulated perception of key variables of person, task, and strategy in relation to the cognitive situation, b) goals, c) actions, and d) experiences aroused by challenging tasks that initiate closer attention towards attaining a learning goal. Later, Flavell's conceptualization of cognitive knowledge gathered under the processes of monitoring, and Flavell's "experiences" emerged as what is more currently discussed as self-regulation (Sperling, Howard, Miller, & Murphy, 2002). Offering a model that exposed dynamics between elements, Brown (1987) drew the more enduring distinction between two main components of metacognition: knowledge about one's individual cognition, and the regulation of cognition by an individual. Brown held that knowledge can appear as declarative (about cognition), procedural (how to learn), or conditional (when and why to apply skills and strategies), and regulation can occur through the main phases of planning, monitoring, and evaluation (Sperling et al., 2002).

Subsequent efforts have included theorizing and research into sequences that occur during metacognition rather than an assembly of components lacking direction. Sperling, Richmond, Ramsay, and Klapp (2012) referred to Zimmerman's 1998 identification of three phases of metacognition. In this approach, forethought precedes performance or vocational control, the phase that subsumes what others have described as monitoring and control. Zimmerman identified the final phase as one of self-reflection during which evaluating standards are applied to learning results. While the components contained within this theory do not

necessarily expand what constitutes metacognition in terms of scope, they do reflect a trend towards having a working model of the metacognitive process with sequencing. Further, such a working model would enhance an understanding of effective iterative processes supportive of collaborative writing.

   Self-regulated learning. The most developed and systematized metacognitive theory is embodied in the field of self-regulated learning (SRL). An overarching goal for learners to reach SRL, in broad terms, describes the constructive enterprise of goal setting by a learner (Greene & Azevedo, 2007). Emphasis on the ongoing involvement of the learner to achieve progress indicates reflective understanding instead of simple success (Brown, 1987), a hallmark of self-regulation, and one that complements collaborative writing's goals. When task performance is self-regulated, metacognition has supported learner efforts (Veenman, Van Hout-Wolters & Afflerbach, 2006).

   A range of self-regulatory processes vary in deliberate or formalized approaches, including autonomous self-regulation often attributed to expert performance, active self-regulation of tasks such as a trial-and-error method, or conscious self-regulation that works from a hypothesis for testing (Brown, 1987). Some models consider more precisely how learners construct an understanding of a task and then initiate and continue decisions about how to proceed towards goals, whether they are learning or performance goals (Butler & Winne, 1995). Azevedo (2005) referred to the contributions of two other notable researchers to the field of SRL, Zimmerman (2001) and Pintrich (2000), to acknowledge that in the SRL process, learners may attempt tasks, demonstrating metacognition and learning despite continued feedback of a sub-standard product, perhaps due to the self-regulatory process of controlling interest in the task. For this reason, the SRL approach appears to emphasize motivation as much as cognition, and

the relationship between the two factors.

By considering a highly literal manifestation of self-regulated learning in the form of independent studying, Winne and Hadwin (1998) developed a model of metacognition that included more actively moving parts. Gathered under the "COPES" acronym, the researchers identified conditions, operations, products, evaluations, and standards as fundamental components of all learning task states, including definition, goals and planning, enactment, and adaptation. As learners progress towards goals (or as named in the model "standards"), they simultaneously consider and respond to internal and external feedback that refines the study process by relying upon these metacognitive processes. This validates the assertion that metacognition should allow individuals not only to predict and control their learning, but also to explain their cognition (Schraw & Moshman, 1995) through recognizing the interplay between monitoring and controlling functions. Additionally, it seems poised to compensate for metacognition's greater ability to actively reflect upon past performance compared to the depth of reflective insight available regarding an unknown future for learners (Lin & Sullivan, 2008). Metacognition does not end with planning, and the critical reflective and evaluative states that would drive effective iteration processes have acknowledgement in Winne and Hadwin's model. Most relevant to this study's design, the model is informed by a sociocognitive framework that incorporates the support that a social context may provide for self-regulation to occur.

Self-regulation and co-regulation. When collaborating within a social context, students need not only to self-regulate, but also to co-regulate the learning of others when working collaboratively, in addition to coping with the impact of the groups' activity upon individual processes (Chan, 2012; Garrison & Akyol, 2015). Hadwin, Järvelä, & Miller (2011) identified three aspects of regulation relevant to collaboration: "self-regulation," "co-regulation," and

"shared regulation." Co-regulation generally describes the way in which individuals, who are all engaged in self-regulation, also regulate each others' learning (Volet et al., 2009). Shared regulation includes regulatory activity targeting common goals and perceptions regarding the unit of the team itself (Hadwin et al., 2011). Schoor et al. (2015) identified multiple researchers who classified pronoun preferences as indicators of learners' regulatory targets: using "I" when self-regulating, "you" when co-regulating, and "we" when shared regulating. As options, self-regulation and the more externalized processes of co-regulation and shared regulation support the iterative nature of collaborative writing by providing learners with multiple and flexible channels for monitoring and controlling cognitive activity.

Social processes and ownership. For high school students, in particular, any social factors would require due consideration of their unique capacities relevant to working with other students. More recent studies on collaborative writing have focused on undergraduate and graduate writers (e.g., Andraesen et al., 2014; Bremner et al., 2014; Brodahl et al., 2010; Caspi & Blau, 2008; Daemmrich, 2010), so limited research is available to develop a clearer idea of how the social processes involved in collaborative writing function for this age group.

The pilot study associated with this project found the same challenge of overcoming ownership issues researched by Caspi and Blau (2011). This study's pilot study examined high school journalists' practices and beliefs about collaborative writing (Kuscenko & Sawyer, in preparation). One of the findings was that the participating high school collaborative writers engaged in more cooperative and less collaborative writing due to inhibitory feelings of ownership over writing. This led the writers to avoid conflict with writing partners due to concerns over how personal writing can be. In Caspi and Blau's study, they found undergraduate students preferred to avoid editing each others' composed text directly and viewed

more direct editing as intrusive. Their study confirmed that ownership awareness can make individuals uncomfortable when suggesting changes to another person's writing (Hadjerrouit, 2014; Wolfe, 1990). Instead of taking ownership of the collaborative writing process, writers may remain focused on individual ownership of writing (Ede & Lunsford, 1990) and avoid constructive conflict. Such an approach would limit the degree of collaborative writing engaged in by individuals.

This tendency, however, is not necessarily beyond intervention. Ens et al. (2011) examined how instructor presence could impact upon constructive conflict between collaborative writers in a graduate academic setting. Prior to receiving instructor-provided feedback by the study's doctoral student collaborative writers, they were uncomfortable with delivering critical commentary. Following the instructor's modeling of this behavior, they reported being influenced to increase their direct disclosure of critical reactions to each others' collaborative writing. Their ownership orientation appeared to shift from individual writing to collaborative writing processes despite experiencing initial discomfort. With adolescents, whose neurological changes disrupt perspective-taking cognitive processes yet also heighten sensitivity to others' expressed emotions (Blakemore & Choudry, 2006), this shift in the orientation of ownership's influence may be more critical and vulnerable.

Collaborative writing objectives. Collaborative writing provides an opportunity to target a range of writing objectives. Collaborative or not, writing in any mode is a process, more than a product (Flower & Hayes, 1981; Greene & Azevedo, 2007). As a type of writing process, collaborative writing presents additional process alternatives compared to independent writing, some of which may be new skills even for experienced writers. As much as collaborative writers may be focused on the distinct objectives of still mastering product-related skills, or process-

related skills for both independent and collaborative writing processes, they also may focus on learning objectives related to any combination of these goals.

 Product objectives. Starting with product-related skills that collaborative writing may target, the popular 6+1 Trait Writing Model conceptualization of effective writing components divides areas of written performance objectives as follows: ideas, organization, voice, word choice, sentence fluency, conventions, and presentation (Education Northwest, 2016). Although every trait allows for consideration of multiple alternatives, the set may be re-ordered according to how universal or standardized such choices may be for student writers. From that perspective, conventions would certainly remain matters of relatively superficial consideration driven primarily by rules for spelling, punctuation, capitalization, grammar, usage, and paragraphing. Organization, adhered to by writers according to a particular structural sequence such as comparison-contrast or problem-solution, may also become relatively formulaic once selected. The same goes for presentation, in terms of how the function of a text drives layout decisions within a predetermined formula. Conceptually, writers cooperate with these components of a written product to manipulate them as puzzle pieces, more than they collaborate with them as problem elements, due to their relatively predetermined and fixed nature.

 The remaining traits of ideas, word choice, sentence fluency, and voice start to present writers with more meaningful and deeper revision targets that may be treated as problems. If targeted during collaborative writing for the level of interest or importance as opposed to pure accuracy, ideas may share the same level of consideration as word choice and sentence fluency. In that case, ideas are not evaluated as right or wrong in an objective way, and may be considered more for how they relate to the writer's ideology or the document's audience. For example, in this study's pilot study, high school journalists reconsidered whether or not using a

particular presidential candidate for a supporting quotation was an effective idea or not. This discussion involved deeper revision than choosing a different quotation from the same candidate since they discussed how readers would react to the idea of that candidate as a quotation source. Although word choice may carry limited lateral impact upon surrounding text and require fewer actual changes to a document, the traits consider figurative devices to function as an aspect of word choice, so it may also become a more meaningful revision target. Sentence fluency may also become more a meaningful target since syntactical devices include consideration of audience reaction to the rhythm and flow of writing.   Such decisions bring writers to engage with the most variable and idiosyncratic component of this framework: voice. As much as voice may be affected by feelings of ownership on a deeper level due to how personal it can be, this is what makes voice such a deep revision target. Targeting one writer's voice would be a deep commitment to revision; conceptualizing and targeting a collective voice for the collaborative writing group would indicate a shift in typical ownership. In all, targeting more meaningful and deeper writing objectives does engage individuals in a more collaborative way with the learning tool of written text.

Alternative schemes for categorizing revision targets do exist. Representative of these approaches is Faigley and Witte's taxonomy (1981) which distinguishes between surface and meaning changes. Surface changes may relate to formal changes (spelling, punctuation, etc.) or meaning-preserving changes (additions, consolidations). Since these types of revisions are meant only to clarify the document, writers who target them are working on a more superficial level. Meaning changes, though, are further distinguished between microstructure changes for limited aspects of the document, or macrostructure changes affecting the document as a whole. Since the pilot study related to this study found that high school collaborative writers have a

tendency to target superficial revision targets, this study will expand the measurement, instead, of the aspects of writing that are more macrostructural in practice. In this regard, the more a writer considers the impact of macrostructural changes upon the document as a whole, the deeper the level of revision target becomes.

In light of these considerations, this study adopts a hierarchical view of the 6+1 Trait Writing Model components to order them from shallow to meaningful and, finally, deeper as follows: conventions, organization/presentation, ideas/word choice/sentence fluency, and voice. However, when the writing process becomes collaborative, even more so than cooperative, any of these traits may, indeed, become deep revision tasks depending upon the level of discourse learners engage in while considering writing options (Scardamalia & Bereiter, 1987).

Process objectives. The cognitive writing process model published by Flower and Hayes (1981) outlined the writing process as a flow between three main actions focused on text production: planning, translating, and revising/reviewing. Although these three main actions are all monitored by the writer, long-term memory has the strongest link to planning activities. The main types of long-term memory drawn into the planning processes of generating, organizing, and goal setting include knowledge of topics, knowledge of audience, stored writing plans, and knowledge of sources.   The model also acknowledges a writer's relationship with beyond-the-text components of the assignment's topic and audience, as well as the text produced so far as another component requiring coordination.

Undoubtedly, differences between individual writing processes and collaborative writing processes require adaptation of this standard writing process model. Perera et al. (2009) suggested considering collaborative writing as incorporating both text-oriented behaviors (addition, deletion, or substitution) and collaborator-oriented behaviors (reading, commenting on

text) in order to capture the collaborative processes pertinent to discourse. Ede and Lunsford (1990) also provided a more specific framework for identifying uniquely collaborator-oriented tasks not included in the Flower and Hayes model. Their framework added division of duties as well as credit of responsibility for the document and writing. This binary categorization points to how many of the tasks completed during independent writing are re-oriented during collaborative writing, but it does not provide for writers' awareness of the relationship between coupled and decoupled activities informed by a distributed cognition perspective. In particular, it only accommodates self-regulation and co-regulation without acknowledging the more collaborative mode of shared regulation.

Scripting a Revision Decision Method

With digital collaborative writing platforms available to learners today, beneficial work mode factors such as availability and synchronicity of learning partners (Rieber, 1992) become more flexible (Boellstorff et al., 2013). Collaborative revision and editing activities may also occur fluidly with online, authentic resources that take full advantage of emergent problems to solve, such as jointly considering word origins just-in-time (Cliff Hodges, 2002), that might otherwise not even occur to writers without having those resources within reach. In the shared space of digital collaborative writing, a moving cursor can create the same socialized learning dynamics of feedback and response between writers (Evans & Bunting, 2012). The expectations outlined by Lowry et al. (2003) to write collaboratively in a common space with common objectives, and in an iterative and social manner including active team processing of the collaborative writing task, are within reach.

However, a shared workspace, no matter what design features exist, does not necessitate meaningful collaboration (Garrison & Akyol, 2015). A group of students could very well spend

time inserting text into a shared document, but that does not mean that they are engaging in collaborative writing. In order to support collaborative writing components of iterative and social processes pursued by a team whose objectives may be distributed across various writing goals, in a way that utilizes document features to deepen such support, research shows that collaborative writing should be thoughtfully scripted. This way, regulated activities lead to enhanced learning (Schraw, 2007).

Scripting the task of collaborative writing can help writers manage the cognitive loads introduced by writing under collaborative conditions, and learners may be able to devote more attention and effort to target processes as a result. Earlier research has found that an increase in information volume related to a decrease in ability to control and structure information during collaborative tasks (McGrath, 1990). More recently, Perry and Morphett (2015) considered how real-time revision and editing during collaborative writing hampers deeper thinking due to the continual demands of monitoring live writing. Similarly, Engel and Onrubia (2010) found that just the discussion of segmenting writing consumed collaborative writers' processing capacity. When providing a script, Wichmann and Rummel (2013) theorized that offloading some of the cognitive load related to information management through the script supported the increases they found in written products, revisions, and task division coordination. Scripted collaboration prompts can produce measurable skill improvement from task to task (Judd, Kennedy, & Cropper, 2010; Yelland & Masters, 2007), yet DeWever et al. (2015) did not find a significant difference in wiki writing quality when working with a script under controlled conditions. However, their study's scripted condition students reported feeling more responsible for wiki writing than the non-scripted group. With the goal of navigating the problem of collaboration processes over-riding completing the puzzle of cooperative products, scripting provides learners

with necessary scaffolding.

The upcoming sections will consider the ability of a script to enhance desirable team dynamics in multiple ways. This section will review and synthesize the findings of other researchers who have intervened with scripts for collaborative writers. After synthesizing salient points about the business-as-usual peer review practices the study seeks to address next, the significance of a transfer orientation during collaborative writing will also be discussed. The important distinction between supporting and suppressing collaboration through scripting will help to review the benefits of a community of practice. Since they resemble such teams, a review of self-reported collaborative writing models will follow. Through these discussion points, this chapter's next sections will elaborate more fully upon the targeted scripting of a revision decision method that aims to scaffold collaborative writers during one of the more critical, challenging, and beneficial aspects of collaborative writing.

Revision decision method in an intervention research context. This study's intervention delineated between revision steps similarly to Wichmann and Rummel's approach (2013), but it attempted to support promotive interaction and metacognition by increasing proximity at critical stages and utilizing a more transfer-oriented process for the actual editing process. During this study's intervention, collaborative writers rotated through a range of roles that comprised an entire distributed cycle of focused revision to collaborative writing. Furthermore, the intervention used threaded commentary to support those activities.

This study's intervention of a revision decision method extended and restructured some of the work by Wichmann and Rummel (2013) from the context of undergraduates wiki writing under scripted conditions, which they found to support greater writing achievement, task division coordination, and revision, in particular. Working from their theory that coordination demands

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are what limit engagement in collaborative writing, their script broke a more complex task into daily activities for groups to follow, and suggested a specific revision sequence. The revision sequence involved one person selecting a sentence requiring revision, posting that sentence to a separate message board, another person editing the sentence, and then a third person integrating it into the wiki-page. These benefits of maintaining the annotated text and its revision discussion within the document itself have been supported by other studies (Boellstorff et al., 2013; Neuwirth, Kaufer, Chandhok, & Morris, 2000).

Another study that informed the revision decision method for this dissertation study comes from a non-digital context but speaks more to optimizing learning gains for writers with varying levels of ability. Yarrow and Topping (2001) found learning gains by both less-able writers and their more-able helpers with a paired writing script for ten and eleven year-old writers. Their script relied on metacognitive prompting and the delineation of distinct writer and helper roles during the entire writing process. In the drafting phase, the helper drafted for the writer while the writer copied, with a gradual shift to the writer gradually writing all of the text. This study's intervention rotation of roles, as well as coupled and decoupled dynamics during that rotation, adapted this approach.

Moving away from business-as-usual. Traditional peer review involving an edit-turn approach reflects business-as-usual instructional strategies. Unlike truly collaborative writing, traditional peer review has repeatedly been found to omit discussion of the writing process itself and, instead, focus on more superficial writing conventions (Storch, 2005). This tendency towards superficial targets may be avoidable by capitalizing upon the flexibility of coupled processes during collaborative writing. When a document is presented in a state closer to completion (after more extended, decoupled drafting), ordered coherence, fewer retractions, and

more elaboration of intact content increase reviewer acceptance (Kibble, 2007; Meyer et al., 2010). This, in turn, limits the dissonance and knowledge creation opportunity offered by two-sided, debate structures (Shaffer, 2006; Felton & Herko, 2004) that more collaborative writing processes, encouraged by a written product in a less finished state (with less decoupled drafting), could offer.

Interestingly, peer-to-peer interaction capitalizing on more frequent and early failure provides much of the benefits of another context of collaborative learning research that informed this study: game-based inquiry learning supported by mobile devices (Squire, 2011). This area of growth provides valuable lessons for how to make more out of collaborative writing process objectives for learners. Mobile learning developers have designed experiences that promote collaboration not competition or simpler cooperation, such as EcoMobile (Dede, Grotzer, Metcalf, & Kamarainen, 2012). EcoMobile gameplay, conducted in the field with both mobile broadband devices that augment reality, allows students to gather and share evidence with speed and fluidity. In doing so, scaffolding through the interaction of player-to-player in-game responses increases since students recognize the need to maintain awareness of each others' acquisition of valuable resources (Klopfer, 2008). A range of applications and studies has confirmed the benefits of peer feedback occurring in response to a relatively incomplete product or process. Roschelle et al. (2010) required individual reevaluation of math lesson answers to reach group consensus using techPALs and observed learning gains. The POSIT augmented reality mobile game (Klopfer, 2008) allowed learners to exchange evidence wirelessly during game play in order to accelerate game progress. Although player successes supported group progress, this kind of dynamic focuses attention on other players' failures to progress, as well. This dissertation study did not attempt to "gamify" collaborative writing, but these findings

about peer interaction during collaboration offer guiding insight. Failures in writing are effectively breakdowns in communication detected by an active audience in response to a relatively unprocessed document. These confrontations of failures are a desirable process in collaborative writing to pursue knowledge-building collaboration instead of knowledge-sharing cooperation.

Moving towards a transfer orientation. If collaborative writing experiences have a main goal of learning the process of how to write collaboratively (NCTE, 2008), that process must be portable and transfer to new collaborative writing tasks. Perkins and Salomon (2012) described how individuals engaged in active transfer perform a detect-elect-connect cycle internally. First, they detect or recognize the similarity between current and prior learning targets. Then, they decide to identify and evaluate possible connections to prior learning that are beneficial to the task at hand. This study's revision decision method will distribute these steps across coupled collaborative writers. Effectively, the detect-elect-connect process that occurs internally will itself be enacted in the revision decision method in order to expose the cognition that is distributed across these processes normally. By turning an internal process into an observable learning artifact, learners should actively manage writing objectives, metacognition, and ownership.

This kind of process transfer may be enhanced if writers generate solutions when writing collaboratively. By generating multiple solutions, they must weigh the interactions between explicit writing features, and their ability to transfer learning from the collaborative writing task to independent tasks may be enhanced (Chi & VanLehm, 2012), thereby fulfilling the potential learning objectives related to collaborative writing processes. Ultimately, a deeper focus on collaborative writing objectives would result in a transfer orientation.

Potential drawbacks of encouraging a collaborative writing process geared towards presenting writers with more problems to fix must also be acknowledged. Perry and Morphett (2015) noted how real-time revision and editing in a document may become a distraction from deeper thinking. Since any peer review process, which is inherent in collaborative writing, may fail due to learners' discomfort with self-reflection or candid criticism (Wirtz, 2012), a more tightly coupled process with a more immediate audience may enhance such discomfort. Overcoming such limitations is worth it, though. Siegler (1995) found that peer reviewers who elaborated upon partnered writers' correct reasoning demonstrated more learning in their own writing, which suggests that providing for both direct document revisions and a channel for revision discussion would support learning. By promoting self-regulation of feedback and changes to a document in more than one retraceable learning artifact, learners may focus on individual learning goals nested in the collaborative process (Andriessen, 2006).

Scripting to support but not suppress. Computer supported collaborative writing workspaces have enabled researchers to gain a better view and understanding of the team roles and dynamics that tend to support effective collaborative writing. Research that applies process mining strategies to collaborative activities has discovered patterns in the kinds of activities learners pursue (Jeong & Biswas, 2008; Perera et al., 2009; Southavilay et al., 2009). In a computer supported collaborative writing task, three components may be scripted, or scaffolded to varying degrees, by design: the learning environment, task, and roles (Resta & Laferrière, 2007). Although predetermining aspects of the learning environment and task may produce indirect results upon the roles individuals adopt within those workspaces, methods for scripting them directly must be considered. This study's script that targets an aspect of collaborative writing will incorporate all three components: how to interact within the learning environment of

a shared document, what to do as part of the collaborative writing process, and distinct roles that occur within that task structure.

Deciding when to script processes is fundamental to design decisions. In this study, the scripting was targeted at one aspect of collaborative writing processes: the decision to revise portions of drafted text. Some advocates of digital learning environment design champion the use of relatively light or limited technology specifically to promote discussion around and beyond the digital workspace (Klopfer, 2008). In one study aligned with that premise, Hu, Ng, Tian, and Lei (2016) provided no script and found that indicators of engagement, self-mention, and verbs highlighting cognitive evaluation during collaborative writing phases were significant predictors of writing quality. In light of these findings, scripting early planning stages too heavily may deprive learners of the opportunities to encounter the need to activate such processes, which may inhibit processes that support later success. Wolfe (1990) scripted by providing ground rules regarding communication during brainstorming and input to make constructive conflict easier; yet Wolfe also acknowledged both the necessity of more social and iterative processes such as listening to viewpoints and discussing drawbacks that heavier scripting may also suppress. When studying Wikipedia, an authentic workspace, Viégas et al. (2004) saw preemptive justifications and edit wars as part of a body of negotiation processes between writers that emerged in that unscripted document environment and community. In light of these studies and findings, this dissertation study aimed to avoid over-scripting by using only light scripting of the drafting phase and targeting the revision phase of collaborative writing with most of its scripting.

This study recognizes that unscripted collaborative writing conditions have been found to carry benefits for learners in more formalized contexts. As a result, it will only target

collaborative writing processes that benefit from a revision decision method rather than provide

extensive scripting for the entire creation of a collaborative document. The intervention should

not overscript and unnecessarily sanitize collaborative writing processes. Unstructured, informal

collaboration has been found to correlate with higher achievement (Stump, Hilpert, Chung, &

Kim, 2011) and increase effortful learning (Clark et al., 2009) especially knowledge building

processes (Hmelo-Silver & Barrows, 2008). These considerations inform, in part, the decision to

script a targeted portion of the coupled processes that occur during digital collaborative writing.

   Community of practice.   One of the reasons to avoid over-scripting is the pursuit of

community of practice dynamics when engaging in digital collaborative writing. When

distinguishing collaborative writing from cooperative writing, building a team of writers rather

than assembling a group of writers may indicate a beneficial level of ownership across individual

and collaborative tasks. Additionally, roles performed during collaborative writing that include

writer, editor, reviewer, scribe and facilitator (Lowry et al., 2003) may shift between different

configurations among collaborative writers. The relationships between novice and expert

learners in a community of practice receive close attention from a situated learning perspective.

Shaffer (2006) described learners working in a journalist-oriented environment labeling

components of their writing in order to publicize their work processes for novice observation. In

collaborative discussions even, Anderson et al. (2001) found that learners using collaborative

reasoning methods demonstrated a snowball effect. In this case, once one person used a strategy

during collaborative reasoning discussions, their peers began to use the same strategies in

subsequent discussions. Methods like these promote what Gee (2004) described as legitimate

peripheral participation. Within a community of practice, legitimate peripheral participation

refers to the unique way that learners begin to view more expert learners as worked examples to

learn from. This learning mode applies to writing processes, as well. Chanski and Ellis (2017) found that high school writers benefit from giving and receiving peer feedback; however, their high school writers who provided feedback to other student writers without receiving feedback on their own writing showed the most writing growth. When observing others' completion and involvement in more critical tasks, individuals are participating in a meaningful way that supports shared growth.

If a community of practice shares a common goal, which creates what Gee also described as a passionate affinity (2004), they also can develop a robustly interwoven skillset, becoming more of a cross-technical team aware and capable of deploying each others' abilities to learning problems. In the collaborative writing process, where topics and problems vary, communities of practice members would fluctuate around roles, only increasing the opportunities to cross-pollinate stratagems and skills. The collaborative writing scripting in this study created opportunities for all participants to observe and conduct simpler and complex steps involved in deciding to revise their collaborative document. In doing so, the study hoped to promote a community of practice dynamic that encouraged ownership of the collaborative writing process.

Self-generated collaborative writing scripts. Collaborative writers working in unscripted workspaces may naturally develop and start to follow their own patterns or scripts, some of which are more productive than others. Research efforts into the authentic and productive self-generated scripts informed the intervention used in this study.

Wolfe (1990) examined the benefits of two methods: a divided approach, and a layered approach. The divided approach resembled cooperative writing more than collaborative writing since writers worked efficiently to create segments of a document with some communication about planning for their eventual coherence. The layered approach provided for a greater degree

of collaboration due to an iterative process for vetting contributions and critiques, as well as making improvements to the document. Additionally, layering promoted ownership and dovetailed with workplace expectations. At least one researcher (Alexander, 2012) reported an increase in the intensity of revision and editing when using a layered approach.

Another set of patterns considered by Mayordomo and Onrubia (2015) mirrored some of Wolfe's approaches, but with alternative patterns for the directions and sequences of a layered approach. First, they found writers naturally following a jigsaw approach that resembled Wolfe's divided method. Although this method also remained closer to cooperation, the researchers examined how writers actually collaborated to distribute writing activities among writers and required iterative and social processes to support eventual combination of segmented drafts.   Alternatively, collaborative writers worked in a second method that the researchers described as a "star" approach. In this method, collaborative writers produced a complete document independently, and then they compiled a joint document by discussing how to combine independent writing into a final, coherent product. With this "star" script, decoupled writing is designed as a coupled product from the beginning. A third alternative, the "chain" approach, incorporated a greater degree of differentiation between collaborative writers since each writer composed a partial segment of a document which was modified sequentially by other collaborators.

In some cases, academics have self-reported about stratagems and behaviors occurring in long-term collaborative writing projects that approach integration or refinement of Lowry et al.'s critical features (2003). In one such study, Boellstorff et al. (2013) self-reported on the collaborative writing process they developed while producing a book-length academic document. The group developed a protocol for using threaded commentary to discuss more involved

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revisions through a turn-taking method. With comment threads, changes to the actual document were made by the final commentator once all writers had the opportunity to contribute to the comment thread. This approach helped the group to meet the collaborative writing goal of seeming to come from one voice (Evans & Bunting, 2012).

The authentic scripts that have emerged naturally from collaborative writers provided valuable design considerations and options for the targeted scripting of revision during collaborative writing that this study pursued.

Revision Decision Method Design

This study's revision decision method was based upon students using a combination of the jigsaw, star, and chain patterns that have emerged in recent studies of digital collaborative writing described in the preceding section of this chapter's literature review. As discussed earlier in the context of coupled and decoupled activities, the distribution of tasks extended and restructured other researchers' interventions (Wichmann & Rummel, 2013; Yarrow & Topping, 2001).

After completing the decoupled writing task of drafting segmented portions of a document independently, students were directed to work under coupled conditions and review each other's independently-drafted segments in an adaptation of the chain pattern. For this "detect" step, students read the segment that appeared after their own and highlighted text that they believed required review by the entire group.

For the next step in the revision decision method, students directed their attention to the next drafted segment, which means they moved onto a segment two steps from their own. The third group member then completed the following, "connect" step for a drafted segment. Picking up what the writer drafted and the first reviewer highlighted, this third group member inserted a

comment in response to the highlighted text that described what seemed to have concerned the first reviewer, as well as offered possible alternatives to how the text is currently drafted. This action nested a star pattern into the revision decision method by including at least two different writers' versions of the same written segment. However, it also used a workspace outside of the document's main text to support monitoring and regulation of the revision activity.

For the next step in the revision decision method, the "elect" step, students coupled their efforts in a more proximal way by talking through their reactions to the comments inserted by the third group member. At this point in time, the group should have made a consensus decision about which option presented by the third group member best addressed the revision need that the first reviewer detected. The group was encouraged to reach consensus, and in the case of failing to do so, leave the decision unresolved rather than resolve it without consensus. This negotiation phase afforded for the kind of light scripting that can also be beneficial for collaborative writers who may all react to comments, changes, and additions in an evolving and iterative chain pattern (Engel & Onrubia, 2010).

Since all collaborative writers experienced every role, they were all engaged with the beneficial detection of problems, and the suggestion of solutions that make peer review correlate with writing quality (Cho & MacArthur, 2011). This third group member ended the chain by adding a comment about the group's rationale behind their decision to resolve or not resolve the revision, and for what reason. This final decision included metacognitive evaluation and reflection upon the revision decision process.

Although Perkins and Salomon's (2012) detect-elect-connect model for transfer follows a different order than how these steps are conceptualized in this study's revision decision method, the rationale adapts the model for the unique demands of digital collaborative writing. At least

one other modification of the detect-elect-connect model has been developed as an intervention for research purposes (Tremain, 2015). The shift from individual election to make a connection from another learning context to the current one occurs within the transfer cycle when reviewing another's drafted text. With a digital collaborative writing group, the transfer moment occurs again, and more aligned with both the rewards and challenges of digital collaborative writing, when the group enacts the actual revision decision upon the text. Within the individual transfer cycle is a nested collaborative transfer cycle. For this reason, the revision decision method shifts the elect step to this final point of the chain sequence.

Closing

For digital collaborative writing to be successful, its iterative processes are supported by metacognition that includes self-regulation, co-regulation, and shared regulation. Collaborative writing objectives also reflect depth in both product objectives and process objectives. The social processes of feelings of ownership are managed by shifting them to ownership of the collaborative writing process instead of individual writing. Thoughtful scripting scaffolds the negotiation, coordination, and communication demanded by collaborative writing.

CHAPTER 3: METHODOLOGY

This study used a quasi-experimental mixed methods design to determine if a collaborative writing intervention, namely a revision decision method, supported high school students' depth of writing objectives, metacognition, and feelings of ownership when engaging in digital collaborative writing. In this study, a treatment group received instruction in the use of the revision decision method scripting, and then used this revision decision method script while engaging in collaborative writing assignments. A business-as-usual control group received the same collaborative writing assignments without scripting through the revision decision method. To investigate the study's primary aims, I collected data via (a) collaborative writing activity artifacts, including threaded commentary for both quantitative and qualitative analysis, (b) surveys for additional quantitative analysis, and (c) a focus group interview and DocuViz visualizations of collaborative writing sessions for additional qualitative analysis. This chapter includes the study's research questions, study conditions and procedures for treatment and control conditions, data collection, and measures

Research Questions

In order to meet the demands of 21st century literacy development applicable to high school students heading to both workplace and higher education, this study, accordingly, pursued two aims.

First, the study sought the primary aim to understand the effects of a revision decision method intervention for high school students' collaborative writing by investigating the following questions:

1. What are the effects of a scripted revision decision method on the depth of writing objectives? That is, do students who participate in the treatment condition (i.e., scripted

condition) have different and/or deeper revision targets compared to the students who participate in the control condition?

2. What are the effects of a scripted revision decision method on metacognition? That is, do students who participate in the treatment condition (i.e., scripted condition) report higher levels of metacognition compared to the students who participate in the control condition?

3. What are the effects of a scripted revision decision method on feelings of ownership?

4. What are treatment students' perceptions of the feasibility and satisfaction of the revision decision method intervention?

Second, the study pursued a secondary aim by identifying high school students' authentic practices by investigating the following question:

5. What self-generated scripts or strategies, if any, for revision decision-making do high school students in the control condition use?

Setting and Sample

The study took place in a comprehensive high school in a large public school district in suburban New Jersey. The district draws from a relatively homogeneous community and fits into the categorization of a "J" district factor group, the far end of the New Jersey system in which "A" district factor groups receive additional education funding from the state. This categorization reflects district's residents' levels of high school and college education, occupational status, unemployment rates, percent of individuals in poverty, and median family income. The district's 2014-2015 New Jersey Department of Education School Performance Report identified the percentage of economically disadvantaged students residing within the district at 2.3%.

Participants

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A convenience sample of two preexisting, concurrent college preparatory sophomore Language Arts classes were invited to participate in the study. One class included 23 students and was randomly assigned to the control condition. Out of that convenience sample pool, 17 students consented to participate in the study. Of those participants, five male students and 12 female students were participants; one student had special needs, namely the student received 504 modifications related to an ADHD classification. These modifications included extended time for assessments upon request. The participating student did not use these modifications during the study's writing and survey activities. The other class that was randomly assigned to the treatment condition included 24 students. Of them, 19 students were participants, including six male students and 13 female students. This second class did not include any students with special needs. Although a higher number of male students included in the overall convenience sample did not become participants, the two participant groups were comparable in terms of their overall gender ratio, thus making them comparable. The ethnic representation of the sample was 75% white, 16.7% Latino, and 8.3% Asian. The age range representation of the sample was 75% sixteen year-olds and 25% fifteen year-olds.

Demographic information was gathered about the participants' self-reported writing experiences, including (a) writing independently, (b) writing with one partner in a paired format, and (c) writing collaboratively with a group of two or more other writers. Most students reported limited experience writing independently, with 36% of students writing independently less than once a month, 25% writing independently once a month, 14% writing independently once a week, 11% writing independently several times a month, and 14% writing independently more than once a week. A chi-square test was performed to determine whether students in the intervention and control groups were significantly different in their reported frequency of independent writing.

Students were categorized as frequent independent writers if they wrote independently once a week, more than once a week, or several times a month; students were categorized as infrequent independent writers if they wrote independently once a month or less than once a month. Results indicated no significant relationship was found between condition and the frequency of independent writing, X^2 (1, n = 36) = .91, p = .272.

The paired writing experience representation of the sample was 53% writing less than once a month with one other person, 22% writing once a month with one other person, 14% writing once a week with one other person, 8% writing more than once a week with one other person, and 2% writing several times a month with one other person. The same categories of frequent and infrequent writers were created for paired writing using the same division as for independent writing. A chi-square test was performed, and no significant relationship was found between condition for frequency of paired writing, X^2 (1, n = 36) = 1.82, p = .255.

The group writing experience representation of the sample was 67% writing less than once a month with two or more people, 22% writing once a month with two or more people, 6% writing several times a month with two or more people, and 6% writing more than once a week with two or more people. The same categories of frequent and infrequent writers were created for group writing using the same division as for independent and paired writing. A chi-square test was performed, and no significant relationship was found between condition and the frequency of group writing, X^2 (1, n = 36) = .01, p = 1.00.

The writing instruction-intensive experience representation of the sample was 80% having taken no writing-intensive courses, and 20% having taken an honors level Language Arts course, with no other reported writing-intensive instructional experiences. The number of students with writing-intensive instruction experience in the treatment group (five female

students, one male student) was twice the number of students with writing-intensive instruction experience in the control group (two female students, one male student). This did not correlate with any reported additional collaborative writing experience, though.

Study Conditions

The design utilized quasi-random assignment to the study condition. Study condition occurred at the class-level. One preexistent class was randomly assigned to the treatment condition. The 19 participants in that class were randomly assigned to eight collaborative writing groups in the treatment condition; the 17 participants in the other preexistent class were randomly assigned to seven collaborative writing groups in the control condition. Non-participating students were included in the collaborative writing groups in both classes through random group assignment. Fourteen of the 15 collaborative writing groups were comprised of three students; the one remaining group was made up of four control condition participants. Random selection was used until a specific writing group reached its maximum capacity, and then the random selection process was attenuated to only include the collaborative writing groups that still required members.

Treatment Condition

In this study, the treatment group received instruction in the use of the revision decision method scripting and then used this revision decision method script while engaging in collaborative writing activities. No direct instruction scripted the treatment group's activity when writing collaboratively in a baseline task. Then, the students received instruction in how to use the revision decision method. Instruction occurred during face-to-face classroom sessions and was delivered with PowerPoint materials, student handouts, and live instructor commentary (See Appendix A). This study's revision decision method script included multiple stages in

order for students to complete detect, connect, elect, and reflect stages.

The revision decision method. Before initiating the actual revision decision method when writing collaboratively, participants first discussed and developed a plan to segment the content for drafting. Students were directed to complete this drafting phase in a sequestered, decoupled workspace by drafting in separate documents.

The detect stage. After completing the decoupled writing task of drafting their segmented portions, students were directed to work under coupled conditions and review each other's independently drafted segments in an adaptation of a chain collaborative writing pattern. For this stage, students copied their independently drafted segments into a shared document. From this point, "segments" correlated with any paragraphs attributable to one particular writer's decoupled drafting.

To perform the "detect" step, students read the segment that appeared after their own, with the final segment's author working with the first segment of the drafted document. All group members completed this step simultaneously, and reviewers were instructed to only highlight text that they believed required review by the entire group. No actual revisions should have been conducted independently. However, since this step determined the revision target(s), it played a critical role in the entire method. Given the next step of this chain phase of the revision decision method, students were guided to simply highlight text without providing commentary.

The connect stage. For the next step in the revision decision method, students directed their attention to the next drafted segment, which means they moved on to a segment two positions from the one they originally drafted when decoupled. The third group member then completed the next, "connect" step for a drafted segment. Picking up what the writer drafted and

the first reviewer highlighted, this third group member inserted a comment in response to the highlighted text that described what seemed to have concerned the first reviewer, as well as offer possible alternatives to the text's drafted state. These alternatives comprised the "connect" step most directly. This action nested a star collaborative writing pattern into the revision decision method by including at least two different writers' versions of the same written segment. One version existed from the original draft, and the student working on the comment thread posed at least one alternative for the highlighted text.

The elect stage. For the next step in the revision decision method, the "elect" step, students coupled their efforts in a more direct way by talking through their reactions to the comments inserted by the third group member. For this study, this conversation occurred outside of the text workspace itself. At this point in time, the group should have pursued a consensus decision about which option presented by the third group member best addressed the revision need that the first reviewer detected. The groups were encouraged to reach consensus, and in the case of failing to do so, leave the decision unresolved rather than resolve it without consensus.

The reflect stage. It was the task of the third group member who performed the connect step for the segment to perform the reflect step for the same segment. This involved two options. One option was to resolve and ensure the revision was made to the text at this point in time, and to provide an additional comment with the group's rationale. The other option was to add to the comment thread an explanation for why the group could not resolve the revision decision. This third group member ended the chain with a reflect step by adding these comments about the group's rationale behind their decision to resolve or not resolve the revision, and for what reason(s).

Collaborative writing tasks. The treatment group completed a baseline collaborative

writing task in a Google Doc posted to Google Classroom. The task required students to compose a collaborative document comparable to their upcoming tasks (See Appendix B). The task required groups to compose a proposed reading syllabus for the upcoming unit of study, along with justification of their selection of stories from the provided literature anthology. This baseline collaborative writing task took a portion of one class period, which was 40 minutes for this particular setting.

After instruction in the revision decision method process, the treatment group practiced this revision decision method by first working with a straw document. The straw document was a predrafted response to a prompt similar in nature to the baseline and collaborative writing prompts that they used at other points of the intervention (See Appendix C). The provided straw document was the same for all collaborative writing groups. To provide enough opportunity for application of the revision decision method, it included a range of errors related to all 6+1 Trait Writing Model rubric considerations that participants could choose to revise in their own collaborative writing tasks. These rubric considerations included ideas, organization, voice, word choice, sentence fluency, conventions, and presentation. (See Appendix D). The researcher monitored and redirected individual students as they completed the straw document practice. The instruction and straw document revision activities comprised one class period.

After practicing the revision decision method when working with the straw document, the next collaborative writing task included the intervention of the revision decision method. This collaborative writing task was oriented towards a classroom function, given that satisfaction in collaborative writing has been tied to the relevance and impact of a project within an organizational setting (Ede & Lunsford, 1990), as opposed to a project with meaning limited to extrinsic rewards. I emphasized to the students that their collaborative writing would not receive

a formal grade, but that it would affect what activities they completed during the unit of study.

Instead of relying mostly upon content area mastery for valid contributions, students all had a

relatively equal opportunity to hold a stake in the outcome of the collaborative document. For

example, not all students may have had new ideas for how to interpret a specific poem, but they

all might have had ideas for which type of poetry they would prefer to read. Thus, the

collaborative writing tasks related to preparing a proposal, progress report, or final report of

students' work within the current unit of study instead of the main curricular learning targets

themselves (See Appendix B). This first real collaborative writing task occurred two days after

practicing with the straw document. This collaborative writing task required groups to propose

roles for an upcoming discussion that described expectations and justification for the roles.

After a six-day period, the same collaborative writing groups completed a second

collaborative writing task using the revision decision method. This collaborative writing task

required groups to propose evaluation criteria for an upcoming discussion that described

expectations and justification for the criteria. To support the generalizability of results, tasks

were consistent in terms of complexity and other salient features. Both of these collaborative

writing tasks occurred during separate class periods and following the same intervals. In the

event that a particular student was absent for the first day of writing the collaborative task, that

student engaged in the collaborative revision of the document on the next or subsequent day. No

participating student missed the entire work session of a particular collaborative writing task; all

students had the opportunity to engage in the processing of the collaborative writing manuscripts.

Control Condition

The control group completed the baseline collaborative writing task using Google Docs

and the Google Classroom platforms. However, they did not receive instruction in the scripted

revision decision method. After seven days (allowing for the straw document practice of the treatment group), the control group then completed the same first real collaborative writing task as the treatment group, but without receiving instruction in the revision decision method. The second real collaborative writing task occurred after another two days. For the control group, the three collaborative writing activities occurred during three separate class periods. In the event that a particular student was absent for the first day of writing the collaborative task, that student was directed to engage in collaborative writing of the document on the next or subsequent day. In order to provide an equitable learning experience for the participants, the control group received instruction in the scripted revision decision method at the completion of the third collaborative writing task. Instruction in the scripted revision decision method, provided for equity purposes, comprised one additional class period.

Procedures

The study required building principal, district superintendent, and Board of Education approval. University IRB approval for the study was also received. Informed student assent and parental consent forms were collected (See Appendix E). The study was conducted over a six-week period from approximately April 3, 2017 to May 15, 2017 comprising eight class periods of participation for both groups of participants.

The mixed methods of the study meant that two datasets were collected. The quantitative and qualitative datasets drew on individual students as the unit of analysis. Of the five research questions, one in particular, the investigation of feelings of ownership, adopted a convergent parallel design in order to investigate if the quantitative findings confirm the qualitative findings (Creswell, 2013).

Google Classrooms were used for accessing and submitting study materials. One Google

Classroom provided materials to and collected materials from the treatment group; another

Google Classroom provided materials to and collected materials from the control group. These

Google Classrooms were password-protected. At the conclusion of the data collection, both

Google Classrooms were archived and were no longer in active use. Data sources and

instruments included (1) collaborative writing documents; (2) collaborative writing document

comment threads; (3) collaborative writing document revision histories; (4) collaborative writing

document DocuViz revision history visualizations; (5) the Garrison and Akyol (2015) self-

regulation and co-regulation metacognition survey; (6) collaborative writing disposition checks;

(7) a focus group interview; and (8) an exit survey. The next section of this chapter will provide

procedures of data collection. Then, a section describing quantitative measures in more depth

will follow. Finally, a third section describing the data analytic plan for all five research

questions will conclude this chapter.

      Collaborative writing artifacts. During collaborative writing tasks, students wrote both

individual and shared Google Documents that they posted to Google Classroom. Sharing

settings for submitted documents were restricted at the end of the intervention. All study

participants were present for at least half of the class time devoted to the composition of each of

the three collaborative documents. The first research question specifically evaluates revision

activity of students, not drafting activity of students, so students who were absent during time

provided to draft the document's original material were still present during the time provided to

revise the documents. As a result, every participant's contributions to three different documents

provided data to address the research questions.

      In relation to the data drawn from the produced collaborative documents, the role of

teacher as researcher was considered as part of the study's design. During the production of

collaborative writing artifacts, I observed collaborative writing groups and made minimal

contributions to group processes by redirecting them to examine instructional material if they

asked for task clarification. Fundamentally, the generalizability of teacher researcher produced

knowledge can be questioned since context limits the teacher researcher's scope of analysis.

Also, insider information introduces bias in a way that qualitative methods only further

complicate when affected by interpretive opportunities. As Hiebert, Gallimore, and Stigler

(2002) asserted, though, how to take practitioners' knowledge and transform it into a

professional knowledge base for teaching in a systematic way continues to evolve. Cochran-

Smith and Lytle (1999) emphasized the added value from practical inquiry informing

professional practices to overcome gaps between formal research results and frontline

classrooms.

Since the earlier phases of teacher researcher efforts, though, newer technologies have

also refined the dynamics and status of teacher research. Persico and Pozzie (2015) described

how the learning design movement incorporates teacher-led inquiry in a more systematic way

due to the affordances of technology for sharing both produced knowledge, especially in the

form of practical interventions, and research artifacts. In their view, the challenge of contexts

that undermines the generalizability of teacher researcher work may be addressed, in part, by

relying on embedded learning analytics in today's technologies. This dissertation project

followed a teacher researcher model, and it also pursued the integration of embedded learning

analytics into its empirical evaluation of collaborative writing artifacts, especially in a

transferable form, through reliance upon the document revision histories and visualizations that

tracked student contributions. For the same reason that these stealthier modes of measurement

provide an alternative to self-reporting of collaborative writing participants, they also inform

student activity more directly. Through the use of information embedded in artifacts, the dissertation project acknowledged the potential critiques for its context limitations and individual bias, yet it also provided amelioration of those influences by taking advantage of current, authentic technologies.

The documents created by the collaborative writing groups provided the main artifacts for collaborative writing activities data collection. A shared document was created, and students copied their independently composed text into that document. Shared documents were used when performing the remaining steps of the revision decision method. First, their shared documents included their detect phase highlighting, and then their connect and elect phase threaded commentary. Any actual revisions made to their collaborative writing were also gathered, with earlier versions accessible through the document's revision history. During the reflect stage, additional threaded comments were posted by participants, as the revision decision method directed participants to engage in commenting about their documents. No such prompting occurred with the control group, although that option was available to them.

At the end of every writing session, individual and shared documents were collected through Google Classroom.

After the collaborative writing sessions, DocuViz visualizations were generated using a Google Chrome plug-in for all shared documents. DocuViz draws from multiple versions of a Google Doc to color-code individual user contributions within a single visualization (See Appendix F). This provides a view of how users' collaboratively written additions and deletions change over time in an authentic workspace. In one study by Wang et al. (2015), DocuViz showed how undergraduate writers collaborated to actively review each others' writing more closely during the collaborative writing phase of outlining text. This dissertation study sought to

extend the use of DocuViz as a method of understanding high school collaborative writers.

Since eight treatment groups completed three collaborative writing tasks, 24 shared documents, and their corresponding revision histories and DocuViz visualizations, were collected. The control group's sets of three shared documents created by seven groups provided another 21 shared documents, along with their respective revision histories and DocuViz visualizations.

The 24 documents produced by the treatment participants, along with their revision histories and DocuViz visualizations, also provided data to examine whether or not the participants used the revision decision method with fidelity. While I reviewed each document, I triangulated between the three views of the document in order to identify that for each document, participants had detected revision needs, connected revision possibilities, and elected to make revisions in the text itself (See Appendix G). I also reviewed the documents to identify that participants had reflected upon the revision decision in the document comment threads. I recorded this evidence in a chart. When participants did not complete a given step in the revision decision method intervention, I made a note of any alternative activity conducted by the participant (i.e., marking a comment as resolved), so that the evidence would substantiate any patterns of deviation. Additionally, I reviewed the observation notes I had taken during the intervention sessions to investigate deviations for which no alternative activity was evident in the document or its related histories. These observation notes were effectively field notes about individual and group behaviors during writing sessions that were not shared with groups, but were used to record both what participants did and what interaction(s) I had with them during the intervention.

Surveys. Participants completed several surveys over the course of the study. Surveys

will be described in detail in the measure section below. Prior to intervention implementation, all participants completed a demographic survey (See Appendix H). All participants also completed a pretest metacognition survey before completing any collaborative writing activities, and a posttest metacognition survey after their final collaborative writing task. Treatment participants also completed an exit survey (See Appendix I). All three surveys were delivered through Google Forms posted to Google Classroom.

Collaborative writing disposition check. After the first and final collaborative writing tasks, students completed a collaborative writing disposition check. This was a paper and pencil task administered and completed prior to the end of the respective class period. The collaborative writing disposition check will be discussed in greater detail in the measures section.

Focus group interview. A focus group interview of students from the treatment condition was conducted. The focus group interview served mainly as an opportunity to gain insight regarding participants' overall satisfaction with the intervention as well as their feelings of ownership. The focus group was asked about the helpfulness and difficulty of the intervention. They were asked to describe whether or not they felt protective of their own writing, or were aware of considering those feelings of ownership in other writers (See Appendix J). The focus group interview lasted thirty minutes.

Not every study participant participated in the focus group; instead, focus group participants were drawn from the pool of students for whom student and parental consent for audiotaped interviewing was obtained. Six of 19 students/parents consented to the audio-recording. Since the focus group interview occurred during a class period, the actual group size of the focus group depended upon availability of the students (i.e., whether students were absent from class). Of the six possible participants, five students were present and available at the time

of the scheduled focus group interview. Those five students participated in the focus group.

The focus group included three male students and two female students. The focus group participants represented four of the eight treatment condition collaborative writing groups. One male student and one female student had previously completed writing-intensive coursework. Three focus group interview students were white, one student was Latino, and one student was Asian.

The focus group interview was audio recorded using two devices in order to provide a backup in case of technological problems. The devices were placed in two locations in order to also record all participants with greater clarity.

Measures

Demographic survey. All participants completed a demographic survey (See Appendix H). Participants indicated their age, gender, race, writing-intensive coursework exposure, and the frequency of their individual and group writing experiences.

Metacognition survey. One relatively recent survey developed and validated by Garrison and Akyol (2015) accommodates both self-regulation and co-regulation, which made it an appropriate choice for this study's incorporation of coupled and decoupled activities. The survey uses a Likert scale of responses from 1 *(very untrue of me)* to 6 *(very true of me)*. For example, items measuring self-regulation included "I am aware of my effort", and items measuring co-regulation included "I pay attention to the ideas of others." Scores can range from 26 to 156 for both types of metacognition combined, and from 13 to 78 for separate self- and co-regulation scores. The researchers' exploratory factory analysis confirmed the two factors of self-regulation and co-regulation, but it did not necessarily establish an interdependence between them. The developers did not provide information on the reliability of the measure. However,

the Cronbach's alpha for the full measure ($\alpha = .88$) was calculated for the current study. The Cronbach's alpha was also calculated for the two subscales of self- and co-regulation ($\alpha = .56$). As a result of the low internal consistency of the subscales, the full measure, rather than the subscales, was chosen as the outcome variable. Although this study did not test a new instrument, it expands the knowledge base of this particular instrument's application with a secondary level participant group.

Two items were added to the survey about personal levels of writing in order to investigate feelings of ownership. First, participants responded to the statement "I reject feedback at times because writing is personal." Participants also responded to the statement "I hesitate when giving feedback to others because writing is personal." Including them in this instrument occurred mostly due to the convenience for the classroom setting and participants, in order to avoid a separate step in data collection (See Appendix K).

The decision to use a metacognition survey instrument for this dissertation project occurred in the context of other approaches to measuring metacognition. The less intrusive approach of participant survey instruments have been developed and validated (Schraw & Dennison, 1994; Sperling et al., 2002, 2012) in order to address the inherent problem with relying upon other measurement methods for metacognition. Metacognition measurement has proven to be especially challenging for researchers. Some researchers have relied upon verbalized descriptions of metacognition (Schraw & Moshman, 1995), such as think-aloud protocols (Ericsson & Simon, 1980) and self-reports (Sperling et al., 2012). Since an individual talking about his or her own thinking simultaneously affects the same individual's thinking (Nelson, 1996; Smagorinsky, 1988), the think-aloud protocol has even evolved into a researched intervention designed to promote metacognition (Reder & Ritter, 1992). Since this study aimed

to measure the effect of a revision decision method upon metacognition, not an actual think-aloud protocol effect, the study did not incorporate this approach to measuring metacognition.

Collaborative Writing Disposition Check. Both treatment and control group participants completed a two-item custom-designed pretest collaborative writing disposition check survey after the baseline collaborative writing task, and a posttest collaborative writing disposition check survey after the final collaborative writing task. The collaborative writing disposition check surveyed participants about their feelings of ownership using two questions. These items applied a six-point Likert scale ranging from 1 (*very untrue of me*) to 6 (*very true of me*). The questions asked participants about their comfort level regarding revising someone else's writing, as well as having another participant revise their own writing (See Appendix L).

Exit survey. Participants in the treatment condition completed an exit survey at the conclusion of collaborative writing activities. Participants answered open-ended questions about their perceived benefits and difficulties related to the revision decision method script. Likert scale response questions asked treatment group participants to express the likelihood of their continued and future use of the revision decision method. These items applied a six-point Likert scale ranging from 1 (*very unlikely*) to 6 (*very likely*).

<div align="center">

Data Analytic Plan

</div>

Qualitative coding and analysis were conducted using Dedoose, an online qualitative research platform. Statistical analysis of the quantitative data was conducted with IBM SPSS Statistics for Windows Version 24.0 (IBM Corp., 2016) along with power analysis using G*Power 3.1.3 software. This chapter will next describe the study's analytic approach for all collected data in relation to the investigation of its research questions.

RQ 1: What are the effects of a scripted revision decision method on the depth of

writing objectives? In order to answer this research question, data was gathered through

Google Documents and comment threads. For every collaborative writing group, a total of three

documents and their embedded comment threads were gathered and used for both the treatment

and control groups: a baseline collaborative writing task and two additional collaborative writing

tasks. For the treatment group, these two additional collaborative writing tasks occurred after

receiving instruction with the study's intervention.

This study used a priori coding to conduct data analysis of documents and their threaded

comments regarding the depth of writing product objectives included in collaborative writing

revision activities. A priori coding was appropriate for this research question since it used a

preestablished set of categories for components of effective writing that may be revised

(Maxwell, 2005). Product objectives a priori coding was based upon the 6+1 Trait Writing

Model rubric. These included ideas, organization, voice, word choice, sentence fluency,

conventions, and presentation. Within these traits, a priori coding also indicated the active

consideration of alternatives in terms of volume. Three levels of alternatives were coded

separately according to whether the comments included one alternative, two alternatives, or more

than two alternatives. For instance, the word choice target may have had several alternatives

suggested by a collaborative writer. For example, a writer may have suggested revising the word

choice of "successful" to "exemplary" or "perfect", thus actively considering two alternatives to

the original draft.

In addition to these seven (trait writing rubric) by three (number of alternatives) codes,

two additional a priori codes were included. A distinct "meaningful" organization target with

two (the original and alternative suggestion) and also more than two alternatives (the original and

more than one alternative suggestion) were coded for in the case that organization was discussed

in a manner that went beyond formulaic pattern following. These additional codes were used when organization revision targets formed a more meaningful revision target by including a change from the current organizational pattern of the text. Therefore, the analysis included a total of 23 codes for writing product objectives depth. (See Appendix M).

Although writing process objectives were also included in the a priori coding plan, no collaborative documents included discussion or revision of the group's approach to the collaborative writing process. Writing process objectives depth would also have been measured using a priori coding. A two by six coding scheme that reflected three levels of process convention targets and process scripting targets would have been coded for how many alternatives were suggested in terms of the process being targeted. For one replacement option, they would have been regarded as level one, and two or more proposed options would also have been coded. Process convention targets would reflect relatively low impact changes to the group's collaborative writing processes, including reminders or efforts geared towards adhering to directions or preestablished scripts. Process scripting targets would have also reflected higher impact changes to the group's collaborative writing processes that added, omitted, or otherwise modified the collaborative writing process.

Following a priori coding, the proportion of meaningful and deeper revision targets for both product and process to total number of revision targets per group was calculated. Since the study could not control for the quality of a draft's starting point, these proportion scores indicated a group's selection of revision targets among the total targets used (Barile & Durso, 2002). To obtain the clearest test of differences between both groups, the treatment and control groups, primary analysis of mean proportion scores was conducted with independent t-tests. Then, secondary analysis with repeated measures ANOVA analysis was run on posttest

proportion scores on collaborative writing tasks two and three, also examining the interaction of group condition with posttest proportion scores.

This dissertation study did not control for individual writing skills and their effect upon collaborative writing products directly. The produced documents themselves were not a distinct portion of the data collection addressing the study's research questions. Still, a quality check using the 6+1 Trait Writing Model rubric was performed in order to investigate whether the output quality was consistent across groups or not (Barile & Durso, 2002). Independent t-tests were conducted to determine whether there were significant differences between mean product quality scores for treatment and control participants at baseline, the second collaborative writing task, and the third collaborative writing task.

RQ2: What are the effects of a scripted revision decision method on metacognition? To address the second research question regarding the effect of a revision decision method upon self- and co-regulation, quantitative data was collected using a metacognition survey. Treatment and control group participants completed Garrison and Akyol's self- and co-regulation inventory two times, once as a pretest writing measure, and again as a posttest measure (See Appendix K).

First, an independent t-test was conducted to determine whether there was a significant difference between treatment and control participants at baseline. Second, an ANCOVA was performed to detect whether there was an intervention effect on metacognition. The ANCOVA test was run using SPSS software on posttest metacognition scores with pretest metacognition scores as a covariate and study condition and time as independent variables.

RQ3: What are the effects of a scripted revision decision method on feelings of ownership? To address the third research question regarding the effect of a revision decision method upon feelings of ownership, qualitative and quantitative data were collected concurrently.

Then, the two datasets were analyzed separately prior to being integrated during the discussion phase in order to evaluate how the quantitative results confirm or disconfirm the qualitative results (Creswell, 2009).

Qualitative data were collected from Google Doc threaded comments, collaborative writing disposition checks, and, for the treatment group, the focus interview and an exit survey. A priori and emergent coding was conducted. A priori coding of pronoun use provided insight into how students' feelings of ownership shifted between individual and collective feelings of ownership over the writing product and process. This a priori coding was performed on Google Doc threaded comments, this focus interview transcript, and the exit survey. Participants' use of "I," "you," or "we" when discussing written product or the writing process indicated ownership feelings since they denoted a metacognitive regulation target of self-, co-, and shared, respectively (See Appendix M). Emergent coding for topics related to feelings of ownership was also conducted in order to describe participants' own concepts and beliefs (Maxwell, 2005).

During this coding phase, participants' responses to questions on the exit survey and focus interview transcript were excerpted in the Dedoose platform. I grouped the excerpts into preliminary categories of drawbacks and benefits of their collaborative writing experiences in order to provide an initial inventory of all salient comments. This basic categorization allowed me to review participants' ideas and consider what topics were reoccurring and, thus, seemed more relevant. I created an outline using the categorized excerpts. To do so, I reviewed each excerpt and added additional subtopics or topics related to ownership feelings until all excerpts had either been placed in outline form or eliminated as unrelated to feelings of ownership. The outlined topics were reviewed with a second researcher for coherence and relevance. This process is described in further detail in the results chapter.

A total of four items were integrated into the study's instruments in effort to create a composite score for participants' feelings of ownership. Two items regarding feelings of ownership were integrated into the metacognition measurement instrument. The Cronbach's alpha of .52 indicated poor reliability for the metacognition survey items (Field, 2009).

Two other items regarding feelings of ownership were included in the collaborative writing disposition check. These questions asked participants about their comfort level regarding revising someone else's writing, as well as having another participant revise their own writing (See Appendix L). The Cronbach's alpha of .81 indicated good reliability for the collaborative writing disposition check items (Field, 2009). Both items from the collaborative writing disposition check included in the composite score used the same Likert scale of responses ranging from 1 (*very untrue of me*) to 6 (*very true of me*).

First, an independent t-test was conducted to determine whether there was a significant difference on feelings of ownership between treatment and control participants at baseline. There was a significant difference between treatment and control groups on their pretest scores. For further analysis, an ANCOVA analysis was run with pretest feelings of ownership scores used as a covariate to detect whether there was an intervention effect on feelings of ownership. The ANCOVA test was run using SPSS software on posttest feelings of ownership composite scores with study condition and time as independent variables, in addition to the covariate of pretest feelings of ownership.

RQ4: What are treatment students' perceptions of the feasibility and satisfaction of the revision decision method intervention? Qualitative analysis of emergent patterns in exit surveys and focus group interview transcripts was conducted. Emergent coding for any discernable patterns or sequences used by treatment groups was used for this dataset. The

general process was similar to how I approached the third research question. During this coding phase, participants' responses to questions on the exit survey and focus interview transcript were excerpted in the Dedoose platform. I grouped the excerpts into preliminary categories of drawbacks and benefits of their collaborative writing experiences in order to provide an initial inventory of all salient comments. This basic categorization allowed me to review participants' ideas and consider what topics were reoccurring and, thus, seemed more relevant. I created an outline using the categorized excerpts. To do so, I reviewed each excerpt and added additional subtopics or topics until all excerpts had either been placed in outline form or eliminated as unrelated to satisfaction or feasibility. Topics that emerged in the outline were reviewed with a second researcher for their coherence and relevance. This process is described in further detail in the results chapter.

RQ5: What self-generated scripts or strategies, if any, for revision decision making during digital collaborative writing do high school students in the control condition use? Qualitative analysis of their self-generated scripts and strategies involved reviewing their document revision histories and DocuViz document visualizations to see if any patterns emerged. These data sources were examined for evidence of collaborative writing strategies used by the control group without instruction or scripting. Since DocuViz color-codes individual writers' manipulation of text over time, the separate visualizations generated by control collaborative writing groups were compared to see if any salient patterns emerged. I maintained a chart that recorded patterns for the 21 collaborative writing documents produced by control groups.

While triangulating between sources (the document, its revision history, and its DocuViz visualization), I first identified documents that appeared to follow the jigsaw model. Following that, remaining documents were reviewed for similar patterns by crosschecking sources from one

document with another. As subgroups emerged, I looked more closely at the three sources of data available for every document in order to identify the prominent characteristic(s) that they shared. Rather than identify patterns that occurred in isolation, I focused on patterns that emerged in more than one document. In the case of truly unique documents, I considered whether or not they would provide additional insight for a tailored case study analysis approach.

During this process of emergent coding, the DocuViz data sources were reviewed both as time point sets (i.e., every group's baseline document), as well as group sets (every document produced by a particular group) in order to detect any patterns that emerged. Emergent codes were reviewed with a second researcher for their coherence and relevance. Individual groups did not necessarily adopt and adhere to only one approach or self-generated script for all three collaborative writing tasks at the group level. As a result, the various roles adopted and scripted by group members in varying configurations within a group emerged as a clearer theme for analysis. Although the theoretical categories of a jigsaw, star, and chain approach were applied in the study's intervention design, emergent coding applied more of a substantive, descriptive approach (Maxwell, 2005) in order to analyze the self-generated scripts applied by control participants in this study.

CHAPTER 4: RESULTS

This quasi-experimental study investigated two primary aims. The study's first primary aim was to understand the effects of a revision decision method intervention for high school students' collaborative writing. To address this first aim, the study pursued research questions regarding the effects of a scripted revision decision method upon (1) the depth of writing objectives targeted during revision, (2) metacognition, (3) feelings of ownership; and it also investigated (4) treatment students' perceptions of the feasibility and satisfaction of the revision decision method intervention. I hypothesized that engaging in collaborative writing with a scripted revision decision method would deepen revision targets, enhance metacognition for self- and co-regulation, and both lessen feelings of personal ownership, and shift ownership to the group's collaborative writing. Conversely, I hypothesized that high school students in the control condition would target more superficial revision objectives, demonstrate lower levels of metacognitive self- and co-regulation, and experience more reported consideration of individual feelings of ownership affecting collaborative writing.

Second, the study's secondary aim was to identify authentic practices regarding aspects of digital collaborative writing by investigating the self-generated scripts or strategies, if any, for revision decision-making during digital collaborative writing used by high school students in the control condition. I hypothesized that any self-generated scripts or strategies used by high school students in the control condition would reflect more cooperative writing patterns than collaborative patterns.

This chapter begins by discussing the fidelity of implementation for the revision decision method intervention. Then, this chapter will present the results of quantitative and qualitative data analysis addressing the study's five research questions.

Fidelity

Prior to investigating the research questions, the data were examined to ensure that the participants used the revision decision method with fidelity. In practice, the shared outlining, jigsawed drafting, and detect-connect-elect aspects of the revision decision method intervention appeared to have been sustained with fidelity to the provided script and instructional materials. There were inconsistencies related to the "reflect" step, the portion of the script that directed participants to add a final comment to threads about the decision to revise or not revise. In both scripted tasks, some treatment participants simply used the feature of marking a comment thread as resolved ($n = 7/19$ and $n = 8/19$) or adding no final, "reflect" comments to the discussion ($n = 5/19$ and $n = 4/19$). As it will be discussed in relation to research question four, the treatment participants had concerns about the time required to complete the revision decision method. Regarding this aspect of fidelity, then, it seems possible that they did not have the time within a given class period to elaborate for a reflect step. Posted comments in threads included rationales for revision suggestions, which suggests participants had awareness of their revision rationale but decided to use another streamlined workspace feature in lieu of repeating earlier stated ideas.

Less common but in more of a deviation from the script, there were two groups that completed revisions to documents but did not use the comment thread feature to do so for the first scripted task. These groups opted instead to discuss their revisions out loud. These two groups were directed to follow the script and use comments in the second scripted task. Observations during the intervention suggest that both groups omitted commenting due to a misconception about directions rather than a conscious decision to revise the collaborative writing process script. A different group did not include threaded comments when completing the second scripted task, and they also did revise and discuss their revisions to the document out

loud. This group included a classmate who was a non-participating student. He had been absent for all intervention instruction and prior collaborative writing tasks, but he was still a member of their group for the then current unit of study. As a result, their omission of comments in the second scripted task appeared to result from efforts to complete the document while also assisting the new group member's understanding of multiple aspects of the unit of study. Given the context of these discernible deviations from the scripted intervention, they do not appear to have affected the study's ability to investigate its research questions, with the exception of the subcomponent regarding revising of the writing process itself for the first research question.

No other patterns of omission or deviation seemed distinguishable. Following this examination of the participants' fidelity to the revision decision method intervention, analysis for the research questions proceeded.

RQ1: Depth of Writing Objectives

The first research question was to examine effects of a scripted revision decision method on the depth of writing objectives targeted during collaborative revision. The study hypothesized that treatment participants using the revision decision method during collaborative writing tasks would target a higher proportion of more meaningful and deeper writing objectives compared to the proportion of more meaningful and deeper writing objectives targeted by control participants.

In examining the proportion of meaningful and deeper revision targets, this study analyzed the quality of the revision occurring during collaborative writing process. The quality of the collaborative writing documents produced through collaboration was not analyzed directly. Still, the depth of revision targets may have correlated with higher or lower quality of the collaborative writing products, so document quality had to be accounted for by the study. Since the study did not control for individual writing skills and their effect upon collaborative writing

products directly, however, the produced documents themselves required a quality check, which is described in the following section.

Document quality check. A quality check using the 6+1 Trait Writing Model rubric was performed in order to investigate whether the output quality was consistent across groups or not (Barile & Durso, 2002) (See Appendix D). It was possible that the quality of the documents composed by the treatment and control groups would have an effect upon the types of revisions pursued by participants in the course of their production. If a group drafted better writing individually, less meaningful revision may have been necessary, which would have affected proportion scores. In order to investigate this possibility, all final collaborative documents were scored using the 6+1 Trait Writing Model rubric with minor adaptations. A total of 30 out of 35 sub-component scores were included in document scores, drawing from the rubric traits of ideas, organization, voice, word choice, sentence fluency, conventions, and presentation. The minimum total score for a single document receiving the lowest score for all subcomponents was 30, and the maximum score for a document receiving the highest score for all subcomponents was 180. "Proficient" scores for every subcomponent included scores ranging from 4 (*capable*) to 6 (*exceptional*). "Not proficient" scores included scores ranging from 3 (*developing*) to 1 (*beginning*).

Five subcomponents were eliminated since the collaborative writing tasks and context did not afford the opportunity for participants to demonstrate or fail to demonstrate adequate performance relevant to these subcomponents. These eliminated subcomponents were: (1) research-based evidence and acknowledgement in ideas, (2) title(s), (3) bibliographical conventions, (4) visual(s) and/or graphic(s) for presentation, and (5) handwriting for presentation. In order to maintain consistency when scoring punctuation in the conventions category, any

document that did not adhere to Modern Language Association conventions for punctuating titles received a "developing" score of three. This was the only other specific adjustment to the rubric's application.

For the purposes of this dissertation study, the document quality was an indication of the availability of both superficial and meaningful revision target choices for participants. In this writing rubric, every item carried the same weight and was scaled from one to six. Documents could not achieve significantly higher mean scores without exhibiting exemplary mastery of all superficial, meaningful, and deeper types of writing components. To conduct the quality check of the writing products, there was no true individual unit of analysis since individual participants collaborated to produce a document as a group. Therefore, the quality check of the writing products was performed at a group level of analysis, meaning which, every document produced by a writing group was evaluated rather than every individual's contribution(s) to that document. A total of 45 group documents were scored using the adapted rubric since every one of the 15 groups composed three collaborative documents. Scores appear below in Table 1.

Table 1.

Comparison of Document Quality Scores (N = 15)

Group	Treatment ($n = 8$)	Control ($n = 7$)	t-test results
	Mean (SD)	Mean (SD)	
Baseline Task	106.38 (12.95)	99.71 (13.24)	$t (13) = -.98, p = .343$
Task 2	107.75 (13.66)	107.43 (15.02)	$t (13) = -.04, p = .966$
Task 3	112.63 (11.29)	99.71 (13.79)	$t (13) = -1.2, p = .067$

Following scoring, an independent *t*-test was conducted in order to investigate any differences in the mean quality of collaborative document scores between treatment and control groups. Since the document quality was an indication of the availability of both superficial and meaningful revision target choices, it was important to establish that document quality was not significantly different between conditions.

When investigating the mean quality of baseline collaborative document scores, there was homogeneity of variance as evaluated by Levene's test for equality of variances; therefore, an independent *t*-test was conducted to examine both groups' mean document scores measured in the baseline collaborative writing task with a 95% confidence interval (CI) for the mean difference. It was found that in the baseline task, the mean document scores in the control group were not significantly different from the treatment group.

When investigating the mean quality of the second set of collaborative documents, there was homogeneity of variance as evaluated by Levene's test for equality of variances; therefore, an independent *t*-test was conducted to examine both groups' mean document scores measured in the second collaborative writing task with a 95% confidence interval (CI) for the mean difference. It was found that in the second writing task, the mean document scores in the control group were not significantly different from the treatment group. This suggests that all groups were presented with superficial and meaningful revision target choices when completing the second collaborative writing task with or without the revision decision method as a treatment condition.

When investigating the mean quality of the third set of collaborative documents, there was homogeneity of variance as evaluated by Levene's test for equality of variances; therefore, an independent *t*-test was conducted to examine both groups' mean document scores measured in the third collaborative writing task with a 95% confidence interval (CI) for the mean difference.

It was found that in the third writing task, the mean document scores in the control group were not significantly different from the treatment group. This suggests that all groups were presented with superficial and meaningful revision target choices when completing the third collaborative writing task with or without the revision decision method as a treatment condition.

The results of the quality check of the collaborative documents indicated that no significant differences in mean quality scores existed between the two groups, control and treatment. Again, the first research question did not investigate the quality of writing produced by the group. This quality check was performed in order to put the revision target depth results into context. It also served to address the study's lack of controlling for writing quality. The midrange scores and lack of significant differences in mean quality scores of document quality suggests that both control and treatment groups were presented with document drafts that contained both superficial and meaningful revision target choices.

Product revision targets coding. All 45 collaborative documents and any corresponding comment threads underwent a priori and emergent coding for revision targets selected by individual participants. A priori coding was appropriate for this research question since I applied a preestablished set of categories for components of effective writing that may be revised (Maxwell, 2005). This a priori coding included the categories of revision targets collaborative writers may manipulate when writing together to create a collaborative document.

During this phase, it was important to differentiate between drafted text and revised text rather than coding both types of contributions made by individual writers. Since drafted sections of text that remained intact without revision did not necessarily involve coupled, collaborative writing processes by participants, these types of contributions would not necessarily help to investigate any effect upon writing objective depth proportions that resulted from the revision

decision method. Segments appearing drafted but not revised would not contribute to measuring the proportion between superficial and meaningful and deeper revision targets. Therefore, such segments were not included in a priori and emergent coding.

In order to adhere to this principle, an approach to identify revised versus drafted material and activity was applied. First, individual document contributions that clearly replaced or integrated with text composed by other participants had to be identified. Second, comments in which writers discussed the need for another writer to make a replacement or change also had to be identified. In order to identify both of these types of revision activity, document revision histories and DocuViz visualizations were examined to determine if they met the operational definition of revision (See Appendix G). The operational definition of revision included contributions that were clearly added at a later date, replaced preexistent text, or had been spliced into the existent text of another writer. Such contributions were considered to be a product of the revision decision method and coded for their writing objective depth in order to investigate this research question.

Once revised excerpts were identified, coding began. During coding, it was important that excerpts had to be viewed in context. Although some studies have investigated revision through an approach of counting characters, changes, and other manipulation of texts in a digital collaborative writing task (Wichmann & Rummel, 2013), this does not necessarily measure depth of revision. A writer may insert extraneous text, irrelevant text, or social text that would not equate to revision depth. Again, the a priori coding using the 6+1 Trait Writing Model rubric as a framework identified voice as the deepest revision target, and word choice, ideas, and sentence fluency as the primary meaningful revision targets. Conventions, presentation, and formulaic organization were considered to be shallow targets. (See Table 2 below). The manner

in which an excerpt was coded for the aspect of writing then corresponded to the broader categorizations of shallow, meaningful, or deeper revision (see Table 2). Table 2 also provides examples from student texts that typify excerpts illustrating all seven main types of revision targets according to their depth levels.

Table 2.

Revision Target Elements, Levels, Codes, Excerpt Examples, and Contributions

Revision Target Element	Revision Target Level	Revision Excerpt	Participant Contribution
Conventions	Shallow	*We want to read this story because we want to see how a woman's beauty in a small town can leave a big impact.*	Corrected "wanted to" tense to "want to"
Presentation	Shallow	**Pitfalls to avoid in a discussion:**	Bolding and colon added by student
Organization	Shallow	*Roles Questions and summary (two people: one per story) Theme analysis (one person: one for each story)*	Delineation of roles with parallel descriptions added by student
Word Choice	Meaningful	*We chose this story because it is about a love story after war that could create a very emotional appeal to its readers.*	Updated "create" and "appeal"
Sentence Fluency	Meaningful	*This will promote a good literature circle discussion because it sparks discussion and debate through the questions.*	Added "because" and combined two sentences

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Ideas	Meaningful	*Instead of listing everything that should be done, we should explain how each one contributes to the discussion.*	Added entire sentence
Voice	Deeper	*Say "further discussion" instead of just "discussion" – we want to show that our group is engaging in a deeper discussion*	Added entire sentence

During coding, every excerpt required examination of the changed text and its context. The layered nature of writing necessitated considering both the manipulated text and its relationship to the document before and after its manipulation by the writer, a relationship clarified more by the revision history than the final draft itself. For example, a revision of sentence fluency would include an entire sentence, no matter how complex it may have been or how many concepts it may have contained. Yet, revision of a sentence's transitional phrases may have indicated more of a focus on organization. Again, the method described earlier to identify revision excerpts afforded both identifying revision excerpts and coding their revision targets. To maintain a more conservative level of coding, the dominant purpose of a revision was generally coded with a single revision target rather than including multiple codes for the same manipulated portion of text.

Some revision targets required specific or exceptional applications of a priori codes that are worth noting. For example, contributions that added subdividing headers to documents from the writing prompts themselves were coded as both organization and presentation writing objectives. These subdividing headers appeared to orient and guide writers and readers, so both

codes fit with the revision target results of those subdividing header additions. In general, other revisions made to the layout and/or design elements (such as indenting, bolding, and bulleting) were coded as presentation revisions. Additionally, contributions that appeared to align material with the collaborative task description more directly through alterations of wording were considered as organizational revisions. When a word form, syntax, or other type of error related to proofreading appeared to be completed for the sake of internal document consistency, it was coded as a convention revision. Also, participants sometimes made revisions that affected multiple segments of a document, such as reorganizing material into a table from paragraph form. To control their proportional weight and remain conservative, these revisions were considered as a single act of revision rather than repeated for every affected paragraph or segment that had been reorganized since they cascaded from a single decision. Additionally, although technically a writer who has drafted text that was subsequently revised by another writer has also experienced revision in a receptive way, moments of revision were only tallied as one-way scenarios in order to, again, maintain a more conservative and consistent view of the impact of the revision decision method upon the proportion of meaningful product revision targets.

After coding, revision target code tallies were then summed for separate shallow revision target subtotals and meaningful/deeper revision target subtotals. Shallow revision targets included formulaic organization, conventions, and presentation. More meaningful and deeper revision targets included ideas, organization (beyond formulaic patterns), voice, word choice, and sentence fluency for stylistic impact. Since the study could not control for the quality of a draft's starting point, proportion scores, not volume scores, were calculated to indicate a participant's selection of revision targets among the total targets used (Barile & Durso, 2002).

Table 3 provides the proportion scores of participants' meaningful/deep targets to

superficial targets. In Table 3, a score of "1" indicates that 100% of the participants' revision targets were meaningful/deep; a score of "0" indicates that 100% of the participants' revision targets were shallow; therefore, the higher the score, the more participants selected meaningful/deeper revision targets.

Table 3.

Comparison of Meaningful Product Revision Depth Proportion Scores (N = 36)

Task	Control ($n = 17$)	Treatment ($n = 19$)
Baseline		
Mean (SD)	0.21 (0.40)	0.02 (0.08)
Task 2		
Mean (SD)	0.16 (0.34)	0.64 (0.42)
Task 3		
Mean (SD)	0.13 (0.33)	0.73 (0.33)

Product revision depth analysis. In the first phase of analysis, an independent *t*-test was conducted to investigate any mean revision depth proportion differences prior to conducting ANOVA analysis of the mean product revision depth proportions. The homogeneity of variance assumption was violated, as evaluated by Levene's test for equality of variances, $t (34) = 2.03$, $p < .001$. As a result, the unequal variance *t*-test was conducted. It was found that in the baseline task, the proportions of meaningful and deeper revision targets to superficial revision targets in the control group ($M = 0.21$) were higher than the treatment group ($M = 0.02$), but this difference was not significant ($t (17) = 1.92$, $p = .071$).

In the second phase of analysis, a repeated measures ANOVA was used to examine

whether there were significant differences in revision target depth proportion scores across the three collaborative writing documents. Post hoc power analysis was completed using *G*Power* 3.1.3 software, resulting in an achieved 0.95 degree of power, $N = 36$ assuming $\alpha = .05$ and a medium effect size ($f2 = 0.15$). Mauchly's test indicated that the assumption of sphericity was not significant ($p = .351$). The assumption of sphericity was met, and all assumptions were satisfied.

The ANOVA test of within-subjects effects showed a significant mean difference in the participants' proportion scores over time. Results from the one way repeated measures ANOVA found a significant interaction between control and treatment condition and the mean proportion scores of meaningful and deeper revision targets in the three collaborative writing tasks, F (2, 68) = 15.28, p <.001, partial $\eta2 = .31$. Results from the one way repeated measures ANOVA also found a significant relationship existed between the baseline, second, and third collaborative writing task revision target depth proportion scores, F (2, 68) = 10.31, $p < .001$, partial $\eta2 = .23$. Post hoc tests using the standard contrast method Simple(1) for the Bonferroni correction revealed that the treatment condition revision decision method elicited an increase in meaningful and deep revision target depth proportion scores from the baseline collaborative writing task to the second collaborative writing task, which was statistically significant, $p < .001$, partial $\eta2$ = .41. Also, the meaningful and deep revision target depth proportion scores on the baseline collaborative writing task to the third collaborative writing task increased, which was statistically significant, $p < .001$, partial $\eta2 = .44$. There was no statistically significant change of the meaningful and deep revision target depth proportion scores from the second to the third collaborative writing task, $p = 1.00$. Overall, I concluded that the revision decision method elicited a statistically significant mean increase in meaningful and deeper revision target depth in

proportion to superficial revision target depth.

Process revision targets coding and analysis. Participants did not include direct discussion of their revision of the group's approach to the collaborative writing process within the data collection plan of the study. Some deviation from the revision decision method script was noted at the beginning of this chapter, and the study's measures did not capture additional data related to revision of the collaborative writing process that was scripted. Consequently, there is a lack of sufficient data to draw empirical conclusions regarding this subcomponent of the first research question regarding the depth of revision for the collaborative writing process itself. Thus, analyses were not conducted for this portion of the first research question because there were no empirical data for this variable.

RQ2: Effect on Metacognition

The second research question was to investigate the effects of a scripted revision decision method on metacognition. The study hypothesized that participants who used the revision decision method would report higher levels of metacognition compared to participants working under control conditions. All 36 participants completed the pretest metacognition survey before completing a baseline task, and the posttest metacognition survey after completing the third, final collaborative writing task. The survey included two subscales: 13 questions related to self-regulation, and 13 questions related to co-regulation. Since reliability was only established for the full scale and not the subscales, the combined scores were used for data analysis. The lowest possible score was 26; the highest possible score was 156.

Table 4.

Comparison of Metacognition Pretest and Posttest Scores (N = 36)

Measure	Control ($n = 17$)	Treatment ($n = 19$)

Pretest		
Mean (SD)	103.76 (13.12)	101.47 (10.98)
Posttest		
Mean (SD)	103.41 (12.31)	100.16 (12.68)

For the first stage of analysis, mean differences between the control and treatment groups' pretest metacognition scores were investigated with an independent t-test. There was homogeneity of variance as evaluated by Levene's test for equality of variances, $t(34) = .57$, $p = .337$. Therefore, an independent t-test was conducted to examine both groups' mean metacognition scores measured in the pretest metacognition survey with a 95% confidence interval (CI) for the mean difference. It was found that in the pretest metacognition survey, the mean scores in the control group ($M = 103.76$) were not significantly different from the treatment group ($M = 101.47$) ($t(34) = .57$, $p = .572$).

For the second stage of analysis, mean differences between the control and treatment groups' posttest metacognition scores were investigated with an ANCOVA analysis using pretest metacognition scores as a covariate and study condition and time as independent variables. Post hoc power analysis with G*Power 3.1.3 assuming $\alpha = .05$ and a large effect size ($f2 = 0.40$), $n = 36$, showed an achieved power of 0.64. Thus, the results of the ANCOVA are underpowered.

The interaction effect between group and pretest metacognition scores was not significant, $F(1, 32) = 1.65$, $p = .209$. Therefore, the homogeneity of regression assumption was met, making it acceptable to proceed with an ANCOVA after removing this interaction effect. The covariate was significantly related to the dependent variable, $p < .001$. Adjusting for the relationship between the pretest and posttest metacognition scores, the analysis showed no

significant difference between the two groups, control and treatment, $F(1, 33) = .27$, $p = .607$. I concluded that there was no statistically significant effect of the revision decision method intervention upon participants' posttest metacognition scores.

RQ3: Effect on Feelings of Ownership

The third research question was to describe the effects of a scripted revision decision method on feelings of ownership. This study hypothesized that participants who used the revision decision method would report developing a sense of collective ownership when engaging in collaborative writing. Several data sources were utilized to answer this research question. Qualitative sources for answering this research question included collaborative document threaded comments, the exit survey, and the focus group interview. Quantitative data were collected through two questions about feelings of ownership that were integrated into the metacognitive survey. Additionally, collaborative writing disposition checks about comfort giving and receiving collaborative writing feedback followed the first and third collaborative writing tasks.

Qualitative findings. A priori coding of pronoun use of "I," "you," or "we" in collaborative document comment threads was conducted in order to investigate participants' feelings of ownership through the lens of regulatory targets. Participants' use of "I," "you," or "we" when discussing written product or the writing process may indicate ownership feelings since they denote a regulation target of self-, co-, and shared, respectively (See Appendix M). Emergent coding for topics related to feelings of ownership was also conducted in order to describe participants' own concepts and beliefs (Maxwell, 2005). Although emergent coding for other feelings of ownership that appeared in the documents and comment threads was planned, participants did not make direct statements about the group's writing processes that required

additional emergent coding of that data source.

Since only one control group used a document comment thread on one occasion, the comment thread data source was considered more independently as a repeated measure of the treatment group without direct comparison to the control group. In practice, the control group did not provide sufficient data for treatment and control group comparison when addressing this question through qualitative data.

To accommodate some treatment group participants' regulation of the document itself directly, without necessarily including a pronoun in their comments, emergent coded added a category for shared regulation through the document itself. For example, stating "This is not needed" as a general evaluation of the document's content reflects a writer's sense of ownership of the document without relying upon one particular person (self or other) to evaluate the need to actively revise the document itself. Results of the percentages of pronoun use are reported in Table 5 below.

Table 5.

Treatment Group Pronoun Distribution Percentages by Task

Task	"I"	"You"	"We"	Direct to Document
Baseline	0	0	0	0
Task 2	0	48	17	35
Task 3	18	27	32	23

Percentages reflect how treatment group participants' total pronoun use was distributed across regulation of writing processes performed by themselves, another writer, or the collective group. The lack of pronoun use in the baseline document parallels the control group's similar and more

persistent lack of use of comment threads as a metacommunicative back channel to discuss the writing process. The use of "we" and direct to document percentages both suggest shared collaborative writing ownership, and these two combined types of uses comprise the majority for both collaborative writing tasks two and three. The highest percentage of co-ownership appears for the second collaborative writing task, which was the first task using the revision decision method intervention.

Distinct use of individual ownership expressions during collaborative writing tasks only occurred for collaborative writing task three. Within excerpts using "I" in the third collaborative document, the majority of the excerpts (80%) did so when expressing agreement or disagreement through sentences starting with "I agree that…." , "I disagree that …." , or "I think …." before elaborating on a concept.

Qualitative analysis was also conducted for open-ended questions on the treatment group's exit survey and the focus group interview transcript. All 19 treatment group participants responded to the exit survey. Five treatment group participants completed the focus interview. Using Dedoose software, excerpts from survey responses and the focus interview transcript were created when participants expressed ideas related to their sense of ownership over writing products and/or processes. After excerpts were created, I grouped the excerpts into preliminary categories of drawbacks and benefits of their collaborative writing experiences in order to provide an initial inventory of all salient comments. After that, I created an outline that clustered excerpts. To do so, I looked for patterns in which participants identified divisions between the self, others, and/or manuscripts. Within those excerpts, once a dichotomy of personal and professional attitudes repeated, I outlined comments that elaborated upon different writing process situations. Since participants described negotiating between those two attitudes during

multiple collaborative writing activities, this approach seemed to fit when and how they experienced feelings of ownership.

To keep building the outline, I reviewed excerpts' relevance to the emerging personal and professional dichotomy and related activities. After exhausting the master list for excerpts that related to this dichotomy and related activities, I looked for additional patterns in the remaining excerpts. Finding that many excerpts merely addressed the self and not negotiated relationships with others and/or the manuscript, I focused on the participants' awareness of when the self overrode group-oriented attitudes, awarenesses, or activities. These excerpts formed the second salient theme addressing this research question. What follows are the results that illustrate the two salient emergent themes related to ownership: (1) the relationship between personal, individual ownership and professional, group ownership attitudes towards writing, and (2) the individual as the ultimate learning unit. These two themes provide some understanding of how collaborative writers knowingly managed their feelings of ownership in reaction to the unique demands and outcomes of collaborative writing experiences.

The relationship between personal, individual ownership and professional, group ownership attitudes towards writing. A quarter (26%) of treatment participants (n = 5/19) described a need to adopt a more "professional" or group-oriented approach towards collaborative writing rather than a "personal" approach. One focus group interview participant explained this shift in ownership from prioritizing your own writing to the group's writing as related to how collaborative writing is "not an accurate representation of what you can do" but "an accurate representation of what the group can do." One focus group interview participant explained that the fact that "you're putting all your names on" the final product distinguishes collaborative writing from simply receiving feedback on your own writing from another writer.

Another survey participant explained that "you may not use your own ideas in order to revise" during collaborative writing, and had to accept that group decisions trumped individual contributions.

Eleven percent of survey participants ($n = 2/19$) noted that being a stakeholder in the consensus process meant that all collaborative writers' ideas counted even if they did not appear in the final group document, and 26% of survey participants ($n = 5/19$) identified the collaborative benefits of every person having an active task when using the revision decision method.

Despite their relatively receptive attitudes about shifting ownership, participants described how others' personal connections to writing process tasks could affect their own ability to pursue more professional, collaborative, group-oriented feelings of ownership. In particular, participants saw personal reactions as affecting open communication of feedback to others' writing, a critical component of effective collaborative writing. Almost half (47%) of treatment survey and focus group interview participants ($n = 9/19$) elaborated on having to consider how personal responses to receiving feedback during collaborative writing could cause disagreements, and thus, impact upon group ownership. More specifically, they acknowledged that thinking about how others might have a more personal reaction to feedback affected their own offering that feedback in the first place.

One focus group interview participant explained that the practice of giving feedback during collaborative writing "is hard because you don't know how the other person is going to take [your feedback, such as] if they're going to take it personally or if they're going to take it professionally." A survey participant acknowledged that some people "do not want to consider" others' suggestions, and another survey participant described how some writing partners could

become "offended" without remaining professional about collaborative writing. These comments illustrate a chain reaction related to feelings of ownership. One writer might appear to prioritize personal ownership during collaborative writing by not elevating the group's tasks above personal feelings. This personal attitude, then, would affect other writers' abilities to pursue and practice group ownership during collaborative writing.

Participants sometimes viewed this as a dynamic related to unique conditions of collaborative writing, rather than a carry-over from independent writing with turn-taking peer review forming part of that writing process. More specifically, another focus group interview participant noted the "immediacy" of feedback during collaborative writing in terms of working more closely together. This condition made reactions to feedback more prominent and created a situation possibly more prone to becoming personal or emotional. Again, writers who reported willing to adopt a professional approach that included group ownership described concerns over how others' personal attitudes could undermine that attitude.

Despite these concerns, only one survey participant reporting disliking editing someone else's writing and a reluctance to approach this role professionally. A much greater percentage of both survey and focus interview participants reporting the benefits of receiving feedback during collaborative writing that warranted overcoming drawbacks (58%; $n = 11/19$).

In all, a picture of collaborative writing being conducted by less individualistic but relevant and equitable contributors emerges. Participants' descriptions of the transition into a professional collaborative writing mode reflected the effort required to negotiate between individual and collective writing products and processes.

The individual as the ultimate learning unit. One third of survey and focus group interview participants (32%; $n = 6/19$) described ownership of learning outcomes on a

fundamentally individual level. When participants discussed benefits of collaborative writing,

benefits were expressed as desirable learning outcomes that belonged to individuals rather than

collaborative writing groups. Of these participants, three viewed their own writing as improving

as a result of collaborative writing, two also elaborated on benefits of viewing the writing

processes of other students, and one focus group interview participant specifically reported

learning as coming from comparing his writing to others' writing. The purposes of learning how

to write collaboratively, or writing abilities that collaborative writing could affect, were

expressed in terms of what the individual experienced ownership of, as opposed to being an

outcome that was shared or experienced by the group. It suggests that collaborative writers shift

to a collective sense of ownership when engaged in collaborative writing activities, but that they

return to a personal sense of ownership when considering the learning outcomes of the process.

Participants described how differences between students could affect long-term growth or

learning during collaborative writing. Fifty-three percent of survey and focus group interview

participants (n = 10/19) noted potential obstacles to group-oriented ownership occurring due to

variation among individuals. Of this subset of ten participants, 60% of them identified types of

variations that emerged from individual qualities, including writing style (20%), writing abilities

(20%), and individual personality differences (20%). Again, participants only tied this concern

to individual differences within a group, not the unique ways that an entire group's combination

would produce a shared writing style, writing ability, or group "personality."

Quantitative findings. The quantitative analysis conducted to investigate this research

question included participants from both the control and treatment groups.

First, the metacognition measurement instrument included two items regarding feelings

of ownership. One item related to rejecting received feedback ("I reject feedback at times

because writing is personal"), and the other related to hesitating when providing feedback due to the personal nature of writing ("I hesitate when giving feedback to others because writing is personal"). These items applied a six-point Likert scale ranging from 1 (*very untrue of me*) to 6 (*very true of me*). The Cronbach's alpha of .52 indicated inadequate reliability for these items (Field, 2009). Therefore, no additional analysis was conducted for these first two items.

Second, the writing disposition check instrument included two other items regarding feelings of ownership. These items related to an individual's comfort level when receiving feedback ("I am comfortable with someone else revising my writing when writing collaboratively") and providing feedback ("I am comfortable revising someone else's writing when writing collaboratively"). These items applied a six-point Likert scale ranging from 1 (*very untrue of me*) to 6 (*very true of me*). The Cronbach's alpha of .81 indicated good reliability for these items (Field, 2009). The descriptive statistics from these two items are reported in Table 6 below.

Table 6.

Comparison of Feelings of Ownership Pretest and Posttest Scores (N = 36)

Measure	Control (*n* = 17)	Treatment (*n* = 19)
Pretest Mean (SD)	10.29 (1.4)	10.32 (1.53)
Posttest Mean (SD)	10.47 (1.28)	10.47 (1.54)

For the first stage of analysis, mean differences between the control and treatment groups' pretest feelings of ownership scores on the collaborative writing disposition check were investigated with an independent *t*-test. There was homogeneity of variance as evaluated by

Levene's test for equality of variances, $t(34) = .03, p = .86$.

Therefore, an independent *t*-test was conducted to examine both groups' mean feelings of ownership scores measured in the pretest collaborative writing disposition check with a 95% confidence interval (CI) for the mean difference. It was found that in the pretest feelings of ownership survey, the mean scores in the control group ($M = 10.29$) were significantly different from the treatment group ($M = 10.32$) ($t(34) = .57, p = .04$).

For the second stage of analysis, mean differences between the control and treatment groups' posttest feelings of ownership scores were investigated with an ANCOVA analysis using pretest feelings of ownership scores as a covariate and study condition and time as independent variables. The interaction effect between group and pretest feelings of ownership scores was not significant, $F(1, 32) = .51, p = .479$. Therefore, the homogeneity of regression assumption was met, making it acceptable to proceed with an ANCOVA after removing this interaction effect. The covariate was significantly related to the dependent variable, $p < .001$. Adjusting for the relationship between the pretest feelings of ownership scores and posttest feelings of ownership scores, the analysis showed no significant difference between the two groups, control and treatment, $F(1, 33) = .002, p = .963$. I concluded that there was no statistically significant effect of the revision decision method intervention upon participants' posttest feelings of ownership scores.

From these results, I concluded that the two groups did not have statistically significant differences in feelings of ownership as measured by the pretest and posttest metacognition survey and collaborative writing disposition check items.

RQ4: Feasibility and Satisfaction of the Revision Decision Method

The fourth research question examined treatment students' perceptions of the feasibility

and satisfaction of the revision decision method intervention using both quantitative and qualitative data. Quantitative results from the exit survey were drawn from one question regarding participants' likelihood of using the revision decision method in the future ("How likely are you to continue using the RDM to write collaboratively?"). These items applied a six-point Likert scale ranging from 1 (*very unlikely*) to 6 (*very likely*). Table 7, below, presents these results.

Table 7.

Exit Survey Results (n = 19)

Response Selection	Number of Participants	Percentage (%)
Very unlikely	1	5.3
Unlikely	3	15.8
Somewhat unlikely	6	31.6
Somewhat likely	4	21.1
Likely	4	21.1
Very likely	1	5.3

Approximately 20% of participants reported being not likely to use the revision decision method in the future, while slightly more participants (26%) reported that they were likely to continue to use the revision decision method. Approximately half of the participants expressed more tentative reactions to using the revision decision method in the future.

Qualitative analysis of emergent patterns in exit surveys and focus group interview transcripts were conducted. During this coding phase, participants' responses to questions on the exit survey and focus interview transcript were excerpted in the Dedoose platform. I grouped the excerpts into preliminary categories of drawbacks and benefits of their collaborative writing

experiences in order to provide an initial inventory of all salient comments. This basic categorization allowed me to review participants' ideas and consider what topics were reoccurring and, thus, seemed more relevant. I then created an outline using the categorized excerpts. To do so, I reviewed each excerpt and added additional subtopics or topics until all excerpts had either been placed in outline form or eliminated as too vague or unrelated to satisfaction or feasibility. Excerpts were grouped according to topic or subtopic based upon the central factor the participant described. In the case of a participant linking factors or discussing multiple factors simultaneously, I separated or duplicated excerpts as needed as they were included in the outline. Since participants often provided a concrete noun that their satisfaction or feasibility ideas related to, the outlining of this process involved limited adaptation. In the case of one topic (conflict), additional emergent coding preceded outlining the excerpts due to the complexity of participants' ideas.

Regarding feasibility, five factors emerged: (1) time, (2) ease, (3) effort, (4) flexibility, and (5) conflict. Regarding satisfaction, three factors emerged: (1) benefits, (2) content, and (3) vulnerabilities. For both the feasibility and satisfaction aspects of this research question, the qualitative analysis provided a view of both benefits and drawbacks of the revision decision method.

Feasibility

Five factors were related to participants' perspectives of feasibility: (1) time, (2) ease, (3) effort, (4) flexibility, and (5) conflict. In general, participants seemed to view the method's logistical demands as justified, especially when collaborative writers perceived a need to work in an organized, professional manner. Although participants expressed their highest volume of concern about the way that the revision decision method exposed unavoidable conflict among

individual group members, most participants ultimately viewed such conflict as a learning opportunity.

Time. Participants were aware of the increased amount of time it took to complete a collaborative writing task when using the revision decision method. Twenty-six percent of treatment participants (*n* = 5/19) noted the increased amount of time required to follow the revision decision method. Many participants described the benefits of the increased amount of time required by the revision decision method. One focus group interview participant explained the time increase as a result of the additional and helpful explanations that writing partners included for each other when using the method. Multiple participants compared the revision decision method to other options used for collaborative writing activities. For example, another focus group interview participant also praised the time factor by connecting the small amount of individual drafting time as providing an efficient way to gain additional collaboration time. One survey participant pointed out that joint composing to maintain the same degree of consensus would require even more time in comparison. This benefit was not supported by another survey participant who considered the less time-consuming approach of traditional peer review to provide equivalent outcomes in terms of writing process and quality.

Ease. Twenty-one percent of participants (*n* = 4/19) acknowledged that the method was not entirely intuitive and that people needed to learn how to do it, and that writers could not adhere to the method without the opportunity to learn it. In terms of the method's simplicity or complexity, 11% of participants (*n* = 2/19) described it as orderly, and 11% of participants (*n* = 2/19) described it as easy to conduct. However, 21% of participants (*n* = 4/19) saw the potential for confusion when following the method. Additional factors affecting ease and difficulty specifically due to conflict are discussed below.

Effort. Participants liked the fact that otherwise off-task group members had clearly defined tasks when using the revision decision method. Twenty-six percent of participants ($n = 5/19$) noted that the method requires every person to complete a task. In general, this appeared to be reported as a benefit by participants in terms of the impact of effort upon their writing partners. Eleven percent of participants ($n = 2/19$) described this as keeping students on task when writing collaboratively. The potential for required effort becoming a drawback to the revision decision method was acknowledged by one survey participant who described this factor as critical to feasibility since "if people don't work, (the revision decision method) doesn't work."

Flexibility. Participants anticipated being able to adapt the method when they were in collaborative writing situations that required more involvement from group members in each other's writing. Thirty-seven percent of participants ($n = 7/19$) described viewing the revision decision method as flexible in use, primarily as adaptable for writing situations or circumstances. Factors specified as impacting upon whether or not to use the revision decision method included: when more help is needed to complete a task ($n = 2/19$) and when a larger group writes collaboratively ($n = 2/19$). In terms of the method's drawbacks regarding flexibility, 16% of participants ($n = 3/19$) described the requirement of finding revision targets when they did not perceive any need for revision in the document to present them with unhelpful inflexibility within the method.

Additionally, 26% of participants ($n = 5/19$) reported experiencing the drawback of a general loss of freedom and control when using the revision decision method. Although some noted the potential shift in ownership as compensation for this loss as discussed earlier in regards to research question three, others specifically reported feeling less like an author as a result ($n = 3/19$) or sensing less pride in their work ($n = 1/19$). Taking pride in their work was tied to

feelings about being named as an author, as well as the grade received by the final written product.

   Conflict. Fifty-three percent of participants ($n = 10/19$) described the role of conflict with regard to the revision decision method's feasibility. This number of participants nearly doubles all of the other themes related to satisfaction with the revision decision method. To provide a clearer picture of this theme, emergent coding exceeded the two simpler categories of benefits and drawbacks to identify descriptions of conflict that were neutral, destructive, or constructive. Examples of such descriptions appear in Table 8 below.

   The reported sources of conflict included: volume of ideas ($n = 10/19$), opinion ($n = 9/19$), personality ($n = 2/19$), writing style ($n = 2/19$), and writing ability ($n = 2/19$). Conflict generated by opinion was generally described as destructive (67%; $n = 6/9$), but also described by nearly all of those participants (83%; $n = 5/6$) as manageable through adopting a professional rather than personal approach during collaborative writing. In this regard, conflict of opinion appears to be a drawback with the potential to become a benefit. Conflict generated by opinion was still regarded as constructive by 16% of treatment participants ($n = 3/19$).

Table 8.

Descriptions of Conflict

Classification	Descriptions
Neutral	-People could have different opinions. -Some people may not agree with revisions. -Not everybody could be on the same mindset. -People may not agree.
Destructive	-Sometimes one person does not agree with the revisions of another person and does not want to consider it. -Students are (sometimes) offended by the revisions. -I think everyone would prefer the majority of the time just working, writing alone because people aren't always going to agree.

	-One of my partners was pretty stubborn about his or her choice, and I didn't really agree with them.
Constructive	-Different ideas can make the material even better. -Receiving feedback is hard, but it is definitely constructive. It can help you build on what you're trying to write. -You get to see different viewpoints and use them in your own writing later, so it's easier to do after seeing more than one perspective on it. -When you're writing, you want to write from a lot of perspectives because people can connect with it.

Satisfaction

Participants' open-ended exit survey responses and focus group interview comments focused most clearly on the feedback received by participants when using the revision decision method as determining satisfaction with the intervention.   Regarding a relationship between feedback received and revision decision method satisfaction, three factors emerged: (1) benefits, (2) content, and (3) vulnerabilities. In general, the volume of feedback received was praised, and participants were also positive about how contrasting ideas and suggestions would ultimately improve their writing.

Benefits. Participants generally reported experiencing the generation of more ideas during the revision decision method feedback process, which they then, in turn, viewed as beneficial for improving their writing. Fifty-eight percent of participants ($n = 11/19$) reported as a benefit that the method generated a higher volume of ideas leading to improvements. Of those participants, 55% ($n = 6/11$) associated idea volume with a better final product, 27% ($n = 3/11$) viewed it as leaving fewer mistakes behind, and 11% ($n = 2/11$) believed it improved the document's message. Sixteen percent of participants ($n = 3/19$) reported a belief in the revision decision method generating feedback that would improve their individual writing.

Content. Participants were also positive about how contrasting ideas and suggestions

would ultimately improve their writing. Twenty-six percent of participants (*n* = 5/19) described the revision decision method as providing writers with more contrasting ideas, two of whom believed having both sides of an idea could lead to a better product, and one of whom thought that would help individuals overcome individual writing biases. Eleven percent of participants (*n* = 2/19) reported more depth to the feedback content when using the revision decision method by discussing structure or providing elaboration. All comments regarding the theme of feedback content appeared to be benefits, as well.

Vulnerabilities. As discussed in the context of earlier research questions, participants' general satisfaction with feedback received when using the method did relate back to the impact of individuals within collaborative writing groups. In particular, focus group interview participants noted concerns that included skill levels leading to one-sided feedback benefits or unhelpful suggestions from their collaborative writing partners. These concerns appeared to be perceived drawbacks to using the revision decision method.

During the focus interview, other aspects of satisfaction related to general learning outcomes beyond feedback were discussed by one or two participants. Some noted the usefulness of learning how to write collaboratively, but also wondered how realistic the method was compared to the individual work of "real" authors. On the other hand, one participant compared her experiences as relevant to working on other group projects in terms of learning how to cope with differences in skill between group members.

RQ5: Self-Generated Scripts and Strategies

The fifth research question investigated whether and what type of self-generated scripts or strategies for revision-decision making during digital collaborative writing were used by students in the control condition. Seventeen control participants were assigned to seven

collaborative writing groups at random within the preexisting class. Each group created three collaborative documents, resulting in a total of 21 documents and their respective histories and visualizations. Within these collaborative groups were also six non-participating students who engaged in all collaborative writing tasks. In order to ensure that the control groups practiced business-as-usual approaches, these participants were not provided guidance with how to process the organization, drafting, reviewing, or general composition of collaborative documents.

Qualitative analysis of their self-generated scripts and strategies involved reviewing their document revision histories and DocuViz document visualizations to see if any patterns emerged. Since DocuViz color-codes individual writers' manipulation of text over time, the separate visualizations generated by control condition collaborative writing groups were compared to see if any salient patterns emerged. This way, it was clear when collaborative writing groups employed a jigsaw approach that broke a document into distinct segments for each writer to draft since segments of a document appeared as solid blocks of different colors (refer to Group 2 Baseline DocuViz in Figure 1 below for an example). Alternatively, if a group employed a chain approach in which each writer composed a partial segment of a document which was modified sequentially by other collaborators, segmented blocks would include the light but predictable presence of other writers' color-coded contributions. If a group applied a star approach, the document could be dominated by the selected draft's one color block with relatively light presence of other writers' color-coded contributions modifying that selected draft in a less predictable pattern (refer to CW Task 3 DocuViz in Figure 1 below).

The DocuViz data sources were reviewed both as time point sets, as well as group sets in order to detect any patterns that emerged. Individual groups did not necessarily adopt and adhere to only one approach or self-generated script for all three collaborative writing tasks at the group

level. As a result, the various roles adopted and scripted by group members in varying configurations within a group emerged as a clearer theme for analysis. Within this category of roles, five distinct roles emerged: (1) designated outlining, (2) jigsawed drafting, (3) designated drafting, (4) nondrafting, and (5) nonreviewing. Among these roles, only the jigsawed drafting role is similar to part of the revision decision method's script for collaborative writing processes. Overall, the application of these separate roles within groups in different configurations suggested a higher level of turn-taking cooperation than iterative collaboration, especially in light of the frequency with which nondrafting and nonreviewing roles were used in writing groups.

Roles: designated outlining. All of the control groups ($n = 7$) adopted an approach of having one group member generate the document's initial outline for at least one of the three collaborative tasks. Fifty-seven percent of the total documents generated ($n = 12/21$) followed this approach. Five treatment groups adopted this designated outliner approach and used it in a total of 63% of the documents generated ($n = 13/21$). When using the designated outlining role, remaining group members would adhere to the outline drafted by a single group member.

Roles: jigsawed drafting. Six control groups adopted an approach of individuals drafting a segment of the document within an outline, but only for 38% of the total documents generated ($n = 8/21$). Some of the remaining documents incorporated the designated drafting and non-drafting roles described below, which means that not all members of the group drafted a portion of the document in a jigsaw drafting role.

Roles: designated drafting. Three control groups adopted an alternative, designated drafting approach, and 24% of the documents ($n = 5/21$) followed this pattern. The designated drafting approach was reflected in how one group member either elected or was elected to draft

the entire document (refer to Group 1 Baseline in Figure 1 for an example of this approach). Of the three groups using this stratagem, one adopted it after having group members who did not contribute to the prior document, and one replaced it when noncontributing group members became contributors in subsequent tasks.

The third writing group that adopted the designated drafting stratagem applied it to both the second and third tasks. Observational notes from their first writing session captured the fact that one group member posted material into the collaborative document that was off-task. The remaining two group members decided to use the designated drafting stratagem as a method for controlling the disruptive writing of their remaining group member.

Roles: nondrafting. At times, individual participants did not contribute to collaborative writing tasks despite being present in class during work sessions, even if the group did not have one group member taking a designated drafting role. In the control group, 26% of participants did not contribute to the first task ($n = 5/17$), 32% did not contribute to the second task ($n = 6/17$), and 24% did not contribute to the third task ($n = 4/17$). Three control groups had at least one noncontributor for every collaborative writing task. (In comparison, during the first and third collaborative writing tasks, one treatment group participant did not contribute to the collaborative writing document, which means 95% of the treatment participants contributed to their documents on two tasks, and 100% treatment participants contributed on the second.)

One of the control writing groups provides an illustrative example of how the nondrafting role was integrated as a collaborative writing stratagem. Figure 1 below provides a DocuViz view of this particular group's three collaborative documents.
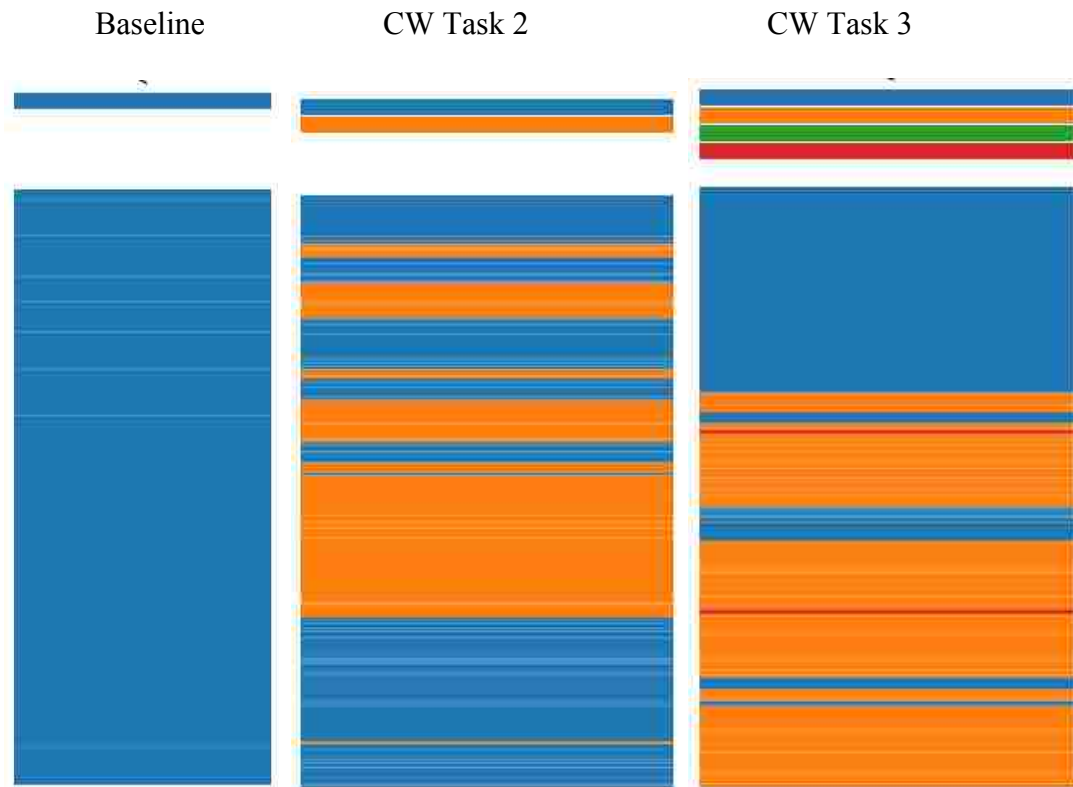
Figure 1. Group DocuViz set for control group 1.

During the baseline task, only one member of a four-person group drafted the actual document. This approach is visible in the solid color blocking of the DocuViz in which one person's blue-colored contributions form the entire document. Some group members did not even access the document when writing, although it was shared with all group members. The produced manuscript's quality resulted in a total rubric score of 107, ($M = 103.27$, $SD = 13.07$). For the next task, half of the group drafted the document, and the other half continued in the nondrafting role. This is visible in the second DocuViz in Figure 1 through the two color-coded sets of contributions, one orange and the other blue. The second manuscript's quality resulted in a relatively high total rubric score of 130, ($M = 107.6$, $SD = 13.78$).

For the third task, all four members of the group drafted the document. This approach is visible in the four color-coded contributions present in the DocuViz (blue, orange, green, and

red). This manuscript's quality resulted in a total rubric score of 114, (M = 106.6, SD = 13.77). The group incorporated the nondrafting role during the first two collaborative writing tasks, but in the third task, they did not apply this approach.

      Roles: nonreviewing. The specific collaborative writing contributions of offering feedback and/or revising the group's document are activities that remained distinct from outlining and drafting new text in a manuscript. Nonreviewing contributors were group members who did not offer feedback to or revise text drafted by other group members. A similar approach used to identify drafted versus revised text described in the context of research question one's analysis was applied in order to investigate reviewing and revising processes in the control group. The control groups remained at a relatively constant rate of nonreviewing contributors that started at 47% for the first task, reached 53% for the second task, and settled at 41% for the third task. Therefore, barely more than half of the participants offered helping feedback when writing collaboratively. (In comparison, the treatment group started at 42% nonreviewing writers for the first task, then dropped to 16% for the second task, and then declined further to 11% for the third task.)

      Additional patterns emerged in some collaborative writing control groups, but they were not all widely adopted within the control group. Two groups rotated the role of designated drafting, and one group appeared to have a group member who completed a final quality check of the composed document. Additionally, control groups appeared to add alternative ideas more frequently than replacing original ideas. These additional patterns confirm the dominance of cooperative more than collaborative strategies in the control group since they limit the iterative decision-making that forms an essential component of collaborative writing.

Summary of Findings

The revision decision method elicited a statistically significant mean increase in meaningful and deeper product revision target depth in proportion to superficial product revision target depth. There was no statistically significant effect of the revision decision method intervention upon participants' posttest metacognition scores. Despite reporting a beneficial shift to a professional, group ownership mode of writing when using the revision decision method, participants considered the learning gains of collaborative writing to be a matter of individual ownership. The two groups did not have statistically significant differences in feelings of ownership as measured by the survey items and disposition checks. The same shift to a professional rather than personal approach to collaborative writing was reported as a critical factor in overcoming a threat to the feasibility and satisfaction of the revision decision method, namely conflict. Participants viewed potentially destructive conflict sources as manageable and constructive through adopting a professional rather than personal approach during collaborative writing. Control group collaborative writing stratagems incorporated cooperative jigsaw approaches to outlining and drafting, as well as resorting to designated drafting at times. Additionally, control collaborative writing groups also demonstrated higher rates of complete nondrafting and nonreviewing by individual write

CHAPTER 5: DISCUSSION

High school graduates who possess collaborative writing skills arrive to higher education or workplace settings more prepared to meet the demands of 21st century literacies. The Council of Writing Program Administration (2014), the Partnership for 21st Century Learning (2013), and the National Council of Teachers of English (2008) all advocate the pursuit of collaboration skills, and these skills are supported by collaborative writing. High school teachers can and should begin to pursue the goals of digital literacy that the 21st century demands by helping high school students to develop collaborative writing competencies. In order to do so, teachers need developmentally appropriate strategies and learning goals for high school students to engage in collaborative writing.

This study investigated whether a collaborative writing intervention, namely a revision decision method, supported high school students' depth of writing objectives, metacognition, and feelings of ownership when engaging in digital collaborative writing. Revision decision method scripting distributed the tasks of detecting, electing, connecting, and reflecting across members of collaborative writing groups. At the same time, a business-as-usual group completed identical writing tasks without scripting. This chapter will include multiple topics in order to fully discuss the context, design, implementation, and results of this study. First, I will discuss the research question findings and relate them to existent literature. Next, I will discuss the significance of the study as well as implications for practice in terms of supporting high school students' collaborative writing growth. Then, I will address the potential limitations of the study in terms of its design factors of sample, setting, and data collection. After identifying recommendations for future research with high school collaborative writers, I will offer a final reflective

conclusion about the project, its outcomes, and its context.

Research Question Findings

In this section, four main findings stemming from the study's five research questions will be discussed. First, significant findings for research questions one and five related to meaningful revision targets involved in promoting collaborative, as opposed to cooperative, learning targets will be discussed. Next, nonsignificant findings for the factors of metacognition and feelings of ownership will be discussed. Finally, findings related to feasibility factors will be discussed.

RQ1 and RQ5: Collaboration versus Cooperative Writing.

The first research question investigated the effect of the revision decision method on the depth of writing objectives, and the fifth research question focused on how the control group developed scripts or strategies for conducting a revision decision-making process when writing collaboratively. In order to effectively describe the benefits of the revision decision method, it is important to jointly consider what writing approaches the treatment and control students used. The two groups' varying degrees of collaboration and cooperation become clearer through this comparison and highlight the role of scripting through the revision decision method.

The difference in the proportion scores of meaningful and deeper product revision targets to superficial targets between the treatment group and control group was significant. This suggests that the revision decision method supported treatment participants' collaboration to detect, evaluate, and revise more meaningful choices about aspects of their collaborative writing in comparison to the business-as-usual group. In contrast, the business-as-usual group appeared to adopt practices that promoted cooperation more than collaboration when writing together. This section's discussion of meaningful revision targets will pertain primarily to revision targets related to *product* objectives. None of the study's participants discussed *process* revision targets

directly, but a brief consideration of this finding will be presented at the end of this section.

Collaboration versus cooperation related to product objectives. In particular, treatment participants targeted ideas and meaningful organization when collaborating with the revision decision method. Revision at these levels of depth correlate with more advanced writing skills (Graham & Perin, 2007). For instance, more advanced writers prioritize material according to its meaningfulness instead of including all possible material to work with – meaningful and superficial – when writing (Sitko, 1998). Both the treatment and control groups in this study were capable of using the critical moment of detection within the method to identify meaningful and deeper targets. However, without adequate scaffolding, the control group did not maintain this approach. This study's treatment participants distributed the decisions to complete meaningful revisions when using the revision decision method, which suggests that the participants overcame some of the added concerns that they reported (i.e., destructive conflict, lack of control, individual differences) and performed despite them.

Instructor role and task distribution. The revision decision method script in this dissertation study decentralized the instructor's role and avoided a hierarchical distribution of tasks by distributing them across writers. After explaining and modeling the revision decision method, as well as guiding treatment groups as they completed the first straw document revision task, collaborative writing groups worked without instructor guidance. During their actual use of the revision decision method, I observed groups and noted their behaviors, and I did not review documents until writing sessions concluded. Writing groups did not ask me to intervene on decisions about their documents, and they maintained full responsibility for producing their documents. I maintained this approach, in part, in order to diminish the potential bias of a teacher as researcher model.

Published studies examining instructor presence have yielded inconsistent results. The validity of removing instructor presence to allow for collaboration to occur has been suggested in a scaled up learning context. Gillani, Yasseri, Eynon, & Hjorth (2014) studied learning networks in two business MOOC courses, one with nearly 90,000 and the other with over 77,000 participants. The researchers found that the networks that distributed tasks across networked learners to a greater degree facilitated the most actual learning in the course. This suggests that task distribution favors meaningful effort at learning, but the study does not provide a contrasting view of performance with increased instructor presence. It can be speculated that this dissertation project's script provided to the student writers through the revision decision method offered scaffolding through scripting that was appropriate and effective for the high school collaborative writer since they were able to both maintain the scripted process and more meaningful revision targets.

In contrast, it may be true that higher levels of instructor intervention can be an effective and desired method in some contexts (Ens et al., 2011) for collaborative writers. For example, a study by Engstrom and Jewett (2005) with close to 400 middle school students working with 11 teachers to write wikis attributed the dominance of superficial contributions to limited modeling and prompting by teachers, suggesting that increased teacher support may have led to more in-depth writing revisions. However, the design of that descriptive study did not provide a more empirical view of the impact of instructor presence, such as what the depth of students' writing objectives were with varying levels of instructor presence. As a result, it does not resolve the question of whether or not the kind of collaborative writing that occurs with heavier instructor presence leads to deeper revision targets and actual learning or not.

In comparison to this dissertation study's decentralized and distributed scripted process,

the business-as-usual control group pursued cooperative approaches with hierarchical task distribution or centralized task control instead. These patterns allowed individual writers to remove themselves from critical tasks, and for the entire writing group to revert to cooperative processes that produced more superficial revision targets. In this dissertation study, the control group did not have a script for collaborative writing, yet by completing the collaborative writing tasks, they did, in some way, cope with the lack of structure for collaboration.

Unfortunately, the desirable outcome of meaningful revision was not supported by the business-as-usual group's coping methods. Despite initially targeting more meaningful revision targets by volume than the treatment group, they fell behind their own initial performance level in this regard, as well as the treatment group's, over the course of the study. Unlike this outcome, some researchers have found that unstructured, informal collaboration correlates with positive results. Stump et al. (2011) found that engineering students demonstrated higher achievement under unstructured collaborative conditions, and Hmelo-Silver and Barrows (2008) found that second-year medical students pursued more knowledge building processes under unstructured collaborative conditions. It is possible that contrasting results of these studies and the current study may be explained by the difference in ages of the participants; it may be that the older populations of Stump et al. (2011) and Hmelo-Silver and Barrows (2008) were more cognitively advanced than the high school collaborative writers included in this dissertation study and as such did not require as much instructor direction. Learners do have to fill the void left without scaffolding, and knowledge construction may accompany those efforts. However, for the high school students in this study who tried to write collaboratively on their own, they demonstrated lower achievement in terms of revision targets. The strategies they used to cope with the lack of structure correlated with lower achievement, and in some cases, decreased effortful learning, as

evident through the noncontributing roles that some groups included as part of their strategy. This suggests that their strategies were less effective.

Specialization of roles. The revision decision method intervention gave all treatment condition writers active roles for coupled and decoupled phases of the method. This provided an optimal specialization of tasks since, on a fundamental level, writers need to rotate between the roles of producer and critic in order to write well (Collins, Brown, & Newman, 1989). Since these specialized roles were generated by the intervention script, though, and did not emerge from authentic practices developed iteratively by the groups, they do not necessarily contribute to the treatment group's attainment of a community of practice dynamic. The treatment group generated shared growth in terms of targeting meaningful revision depth and applying a professional mode of collective ownership towards collaborative writing product and process. These developments characterize the treatment group more as a community of practice than the specialization of roles. The specialization of roles facilitated these other developments, but they did not form the primary dynamic that aligns with that theoretical perspective.

The control group's specialization of roles, by comparison though, was nonoptimal. When they designated tasks such as outlining and drafting, they restricted other writers to troubling counterpart roles of not outlining and not drafting. This means that some control condition writers offered no feedback during all collaborative writing tasks. The business-as-usual group's nonoptimal, hierarchical, or centralized approaches allowed for writers to remove themselves from critical tasks. For those control condition collaborative writing groups, this meant that collaborative writing reverted to cooperative processes that produced more superficial revision targets.

As I discussed in the literature review chapter to provide theoretical contexts for this

dissertation study, specialization of tasks does have support from community of practice theory, and it is worth using as an evaluative framework for the business-as-usual group. Within a community of practice, legitimate peripheral participation refers to the unique way that learners begin to view more expert learners as worked examples to learn from (Gee, 2004). A collaborative writing group that approaches a community of practice would understandably involve varying and specialized roles, some of which allow writers to observe each other during writing processes in order to make learning gains. As presented in the results of the study, I reviewed the patterns for two control writing groups in order to evaluate whether the participants practiced learning through observation of specialized roles. I found that they did not seem to develop community of practice dynamics. The following paragraphs briefly discuss those two control groups and my conclusions about their failure to develop community of practice dynamics.

One of the writing groups provided an illustrative case study within the control group that suggests they failed to reach the observational learning strategies that typify community of practice dynamics. At first, two students produced a comparatively better-written manuscript, according to its score on the 6+1 Trait Writing Model rubric. However, when the remaining group members became involved, no significant gains in overall document quality or individual measures of revision targets, metacognition, or feelings of ownership occurred. Given the lack of meaningful contribution of these later-to-enter group members, the third and fourth group members do not appear to have benefitted from observational learning within the context of these writing sessions that took a hierarchical, centralized approach.

In another control writing group, specialized roles were also adopted by group members and should be considered in their relation to community of practice theory. Ultimately, their

approach not only failed to produce observational learning patterns, but it also limited the group to simple cooperative writing. In this group, one student disrupted their process by inserting irrelevant and off-task content to their documents; as a coping mechanism, they decided to control the disruptive writing of one group member by having another student complete all of the writing tasks for the group independently. Shared and equal status in a document's production can lead to conflict in a less-functioning group (Higgins, Flower, & Petraglia, 1992), and this group appeared to adapt the single writer strategy to avoid such conflict. The problem is that the group eliminated segmentation in order to avoid conflict, and they eliminated nearly all the defining characteristics of collaborative writing. The "iterative and social process" during which "a team … negotiates, coordinates, and communicates during the creation of a common document" (Lowry et al, 2003, p. 12) was restricted to one moment: deciding who would create the document. In doing so, they reverted to centralized, hierarchical control over the writing process and eliminated the opportunity for observational learning that could have still yielded a community of practice dynamic. Instead of tying knowledge, thinking, and the contexts for learning together inextricably and situated in authentic practice (Barab & Duffy, 2012), they shut down those interdependent processes.

Given both of these control groups' dynamics that provided the opportunity to consider community of practice dynamics, it appears that the business-as-usual high school collaborative writers pursued hierarchical or centralized approaches that promoted cooperative writing rather than collaborative writing. Further, their cooperative writing did not result in pursuing more meaningful revision targets. Rather, they avoided meaningful revision targets even though they had earlier demonstrated the capability of targeting them.

It can be speculated that this dissertation project's revision decision method script

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appears to have scaffolded treatment students enough to perform without a direct hierarchical task distribution or centralized control model provided through instructor presence or concentration of support. Once students understood the revision decision method script, they maintained fidelity to the script and pursued more meaningful revision targets. Although they demonstrated the potential outcome of a community of practice in terms of specialization of tasks, without the iterative attention to process, they did not necessarily function as a community of practice.

In all, the business-as-usual group adopted cooperative strategies that produced more superficial revision targets; the treatment group adopted collaborative strategies that produced more meaningful revision targets when using the revision decision method.

Collaboration versus cooperation related to process objectives. Multiple available studies on digital collaborative writing have acknowledged that there are two distinct outcomes of collaborative writing: product and process (Boellstorff et al., 2013; Ens et al., 2011; Kittle & Hicks, 2009).   Even though this dissertation study's participants did not discuss revision of their collaborative writing processes directly, they reported positive experiences about the collaborative writing process. Other studies have found learners open and receptive to the unique opportunities of real-time revision and editing conditions (Suwantarathip & Wichadee, 2014; Zhou, Simpson, & Domizi, 2012). To build on the enthusiasm for real-time revision and editing collaborative processes, additional scaffolding or time may support high school collaborative writers to engage in a more iterative approach to those processes. Promoting an iterative approach would encourage the growth of both collaborative writing capabilities and beneficial knowledge building (Evans & Bunting, 2012). This chapter's consideration of limitations, implications for practice, and future research suggestions will re-visit this study's

participants' particular lack of direct discussion of collaborative writing processes.

RQ2: Maintaining Metacognition.

The second research question focused on the effect of the revision decision method intervention on students' metacognition, with the hypothesis being that the treatment condition students would experience increased levels of metacognition. This hypothesis was not supported because no significant differences were found between the treatment and control group's metacognition survey scores. This suggests that the revision decision method did not lead to participants experiencing a significant change in metacognitive regulation or the targets of metacognitive regulation when using the revision decision method during collaborative writing.

Fundamentally, the length of the intervention may have limited any significant change in metacognition for the study's participants. Although collaboration to target more meaningful revision occurred for the treatment students, collaboration alone does not mean sufficient reflection occurred for learners (Sitko, 1998). Metacognitive growth requires substantial time, effort, and experience (Jakubowski & Dembo, 2004; Winne & Stockley, 1998). Other studies from a range of disciplines that found significant metacognitive gains also involved longer durations closer to a full semester (Al-Rawahi & Al-Balushi, 2015; Chang, 2005; Chang, 2007; Şen, Yılmaz, & Geban 2015). Interestingly, one study that also had a six-week intervention period did find significant increases in metacognition of undergraduate students (Mair, 2012). The difference may be that the Mair study included frequent and extended opportunities to engage in reflective journal writing. This dissertation study's intervention did not include additional reflective writing beyond survey completion and threaded commentary. Since an individual talking about his or her own thinking simultaneously affects the same individual's thinking (Nelson, 1996; Smagorinsky, 1988), more extended metacognitive reflection may have

made it difficult to investigate the main effects of the revision decision method itself upon metacognition. Ultimately, this study's participants most likely required additional time beyond six weeks to gain enough experience using the intervention so that the reflection embedded in the method could develop significant metacognitive shifts.

The study's participants' lack of revision of the collaborative writing process itself also may relate to the lack of significant metacognitive shifts. Multiple studies of collaborative writing have emphasized that collaborative writers should actively discuss their collaborative process. Accordingly, academics have advocated providing collaborative writers with the opportunity to experience awareness and discussion of the implications of working in a real-time revision and editing workspace (Kittle & Hicks, 2009). For example, Rice (2009) studied 19 undergraduates enrolled in a technical writing course who had control over critical process decisions, such as whether or not to allow public commentary and access to their developing wikis. Participants in the Rice study attributed such metacognitively reflective and active decision-making opportunities as critical to their learning outcomes. In another study by Brodahl and Hansen (2014), 21 of their 29 undergraduate collaborative writing groups used chat fields or additional documents specifically to discuss and "process" their collaborative writing process. Although these studies did not directly measure metacognition, as a result of finding ways to discuss and thereby complete a process, the writers engaged in metacognitive monitoring, regulation, and evaluation.

For the collaborative high school writers in this study who are also likely to be less advanced in their writing than undergraduates, increased teacher scaffolding may have been needed to support metacommunication about their collaborative writing processes which, in turn, may have created the opportunity to engage in metacognitive reflection.

This scaffolding would not just offer the time and space to discuss their collaborative writing processes, but this scaffolding should also model the metalanguage, which is required to identify and reflect upon processes. In the context of examining the relationship between metacognition and feedback during the writing process, Butler and Winne (1995) asserted that an increase in students' verbalization of strategies used in writing cued additional monitoring of cognition that would not occur without verbalization. This aligns with ideas about the impact of think-alouds discussed both in this dissertation's methods chapter and earlier in this discussion chapter. The social processes of collaborative writing, though, suggest that think-alouds may occur between collaborative writers. In support of this view, Kuhn, Goh, Iordanou, and Schaenfield (2008) have pointed out that students use and practice metalanguage about writing when talking to someone else about their writing. Butler and Winne (1995) also emphasized, though, that learners need access to information required to complete a metacognitively rich task, and guiding writers with ways or opportunities to verbalize their processes provides a vehicle for metacognition. Writers of all ages, context, and abilities are capable of decision-making processes that go into writing, but they do not always have the capability of elaborating upon this process (Dix, 2006).

Some of the methods for promoting metalanguage about the writing process adopt a sentence stem or sentence starter strategy, where students select from ways of beginning comments that they then complete in the context of the manuscript (Rosenshine & Meister, 1992). For example, students may select from options such as "An even better idea is …" when raising content concerns, or "We can tie this together by …" when raising organization concerns. Heavier scripting has also been used by other researchers to support metacognition, in particular, through questions prompting evaluation. For example, Yarrow and Topping (2001) provided

their paired writers with questions ranging from aspects of meaning (i.e., "Are thoughts or feelings described clearly?") to spelling (i.e., "Are unusual words spelled correctly?"). Other researchers have advocated for developing more structured, devoted spaces for discussion of process to occur with digital collaborative writing in order to raise awareness of process (Kasemvilas & Olfman, 2009). Thus, a possible iteration of this intervention would be to include a discourse mode which would provide students with the opportunity to use and develop metalanguage.

In all, although the simplest explanation for a lack of significant shift in metacognition relates to the dosage and duration of the intervention, these additional factors point to limitations, implications for practice, and future research directions that will be discussed more fully later in this chapter.

RQ3: Recognizing the Need to Shift Ownership. The study's third research question centered on the effect of the revision decision method intervention on writers' feelings of ownership. This question drew from an awareness of the social processes inherent in collaborative writing and used concurrent triangulation (Creswell, 2009) to follow a convergent parallel design (Creswell, 2013). Qualitative results suggested that participants managed feelings of ownership in a way that supported their engagement in the revision decision method, although quantitative results did not confirm that the intervention had any effect on feelings of ownership. Quantitative results did not directly confirm these findings, but they do suggest the efficacy of the participants' approaches to managing feelings of ownership.

In the interest of promoting collective ownership, the study's intervention scripted the process of transition between coupled and decoupled collaborative writing tasks. In this regard, high school collaborative writers in this study did understand and work with the awareness of

how the entire manuscript belonged to the group and did not engage in individualistic edit wars. When coupled, they prioritized the group's outcomes over individual outcomes. They demonstrated ownership of working in a professional, as opposed to personal, mode of writing.

This dissertation study's participants' feelings of group ownership seemed to have focused generally on the *product* of the collaborative writing, which may be why they did not seek group ownership of the *process*. Earlier, I described how some participants treated the produced manuscript itself as a shared target. With undergraduate wiki writers, DeWever et al. (2015) also found that using a collaborative writing script correlated with higher levels of responsibility towards the produced manuscript. What makes this outcome promising for collaborative writers is how it points to long-term writing growth. For Rice (2009), the attitude of "active investment" that ownership of group product signifies may lead to a transferable "ability to productively innovate and execute writing tasks" in other situations (p. 312). However, for this study's high school collaborative writers, the focus on *process* described by Rice did not co-occur. Johnson, Johnson, and Smith (1991) underscored group processing of their collaborative process as a critical component of how learners shift from individualized, competitive approaches to group-oriented collaborative approaches. Without actively engaging in process reflection, this dissertation study's participants may have felt competent when entering into a "professional" writing mode that supported collaboration. This may also explain why the quantitative data does not confirm the qualitative findings for this research question. However, the participants may have missed the opportunity to increase the flexibility of their feelings of ownership. Along that divide, their focus on the product of the collaborative writing became the focus for feelings of group ownership. This may have prevented their expansion of group ownership to the target of process, which offers an explanation for why they did not pay

attention to collaborative writing process.

These restrictions may also explain why some treatment participants did not plan on using the revision decision method in the future even though they demonstrated group ownership of what they wrote. Some participants expressed a preference for more traditional one-on-one turn-taking peer review methods. Elgort, Smith, and Toland (2008) found similar results when working with 16 graduate students and 18 postgraduate students enrolled in information management courses who either reported on topics to their peers or prepared a guide for online resources through collaborative writing. Most students in their study agreed that the group assignment provided valuable learning, but they found a significant number of students still preferred individual learning instead. These results paralleled the dissertation project's high school participants' tendency to revert to individual level learning gains when reflecting on their experiences. It seems as though ownership does not target only the individual or group results during collaborative writing, but that it divides between the two based upon the learner's context.

RQ4: Revision Decision Method Feasibility and Satisfaction.

In addition to the research questions that investigated the effects of the revision decision method script, data was also gathered related to the utility of the method to pursue the fourth research question. Given the concerns expressed by the study's participants, the intervention appeared to provide adequate scaffolding to control drawbacks and increase benefits for collaborative writers. As much as participants were hesitant about future use of the method, this appeared to relate to the time required to fully practice the method as opposed to problematic features of the method itself.

Like this dissertation study's participants, Brodahl and Hansen's (2014) higher education student group also voiced concerns about how challenging it was to combine different writing

styles and individual contributions while still pursuing a consensus-driven final manuscript. However, in their study, persistent concerns of their 154 survey participants included: fears of insulting colleagues, miscommunication, feeling scrutinized, manuscript quality compromises, and loss of control. Considering the age difference and semester-long writing experiences in comparison to this dissertation project, the participants in this dissertation project described similar concerns and expressed that the revision decision method was a way to cope with them.

To underscore the method's efficient targeting of learning gains without extended amounts of time, consider Su and Beaumont's (2010) case study of four undergraduates working on a final year literature review wiki project. After three months' wiki writing, 53% of the students reported no longer experiencing concerns over their peers' reception of their comments. What makes this even more noteworthy is that their comments were dominated by high-level evaluative ideas at that time, as well, so they were more challenging to generate and receive. As much as this dissertation study's participants viewed the time to execute the method fully as one of its major limitations, the increase in time required to apply the revision decision method may decrease the number of dosages required to develop proficient collaborative writing process.

Students in this dissertation study's treatment group were aware of unavoidable individual differences in writing skills and styles, but they generally viewed them as sources of constructive conflict, which is a desirable state in collaborative writing (Wolfe, 1990). The dissertation study's participants indicated that they appreciated the opportunity to share and receive multiple ideas, which have been reported to be one of the main highlights of real-time revision and editing collaborative writing (Daemrich, 2010; Hodges, 2002).

Implications for Practice

The 21st century literacy standards outlined by the National Council of Teachers of

English include building collaborative relationships that design and share purposeful information in a way that requires individuals to integrate real-time input (2008). Workplace and higher education collaborative writing expectations and demands exist (Lardinois, 2012; Rao, 2011), and our students must develop the skills to meet those expectations and demands. Although the high school collaborative writers in this study acknowledged the revision decision method needed to be learned, they also found that the method enabled them to cope with obstructive conflict and to promote constructive conflict unique to collaborative writing. The high school collaborative writers in this study quickly reached and then maintained an increased level in revision target depth, against the tendency to revert to superficial revision targets by adolescent writers that is well-supported by research. This suggests that teachers can and should begin to pursue the goals of digital literacy that the 21st century demands by supporting high school students' collaborative writing. This section will discuss ways to enhance the efficacy of the intervention method for high school students learning how to write collaboratively.

Collaborative writing promotes deeper learning in a way that makes it valuable beyond a learned skill in itself. Peer review processes for independent writing conducted in the classroom, in particular, can be plagued by superficiality (Graham & Perin, 2007; Paulson, Alexander, & Armstrong, 2007). If high school writers improve the meaning and depth of their revision conducted during the peer-to-peer distributed process of revision promoted in the method, this might serve as a scaffolded support for transferable, independent performance in other writing contexts. Rather than consider collaborative writing as adding a new set of skills to Language Arts classrooms, collaborative writing might be an effective mode for learning skills currently included in, but not successfully acquired in, other writing modes. As discussed in chapter one, this approach has started to emerge in first year composition reform movements, and this

dissertation study suggests that doing so for high school writers may also be developmentally appropriate.

This study's high school writers found that time affected their ability to fully engage in collaborative writing. Further, the data analysis suggested that metacognitive reflection and revision of the collaborative writing process itself may have been affected by timing. In light of these concerns, more strategic implementation of the intervention method may involve increasing the amount of time devoted to existing opportunities, and then considering the need for additional opportunities for collaborative writing. Additional time to reflect on processes may support desirable metacognition and shifts in feelings of ownership. Such an expansion would also permit greater opportunity for collaborative writers to actively evaluate and revise their collaborative writing processes. Alternatively, the use of other strategies mentioned earlier in this chapter (i.e. providing a menu of metacognitive sentence starters and stems, guiding writing groups to name group practices) could address these gaps without necessarily expanding the time footprint of the revision decision method.

Promoting the acquisition of a more developed metalanguage to discuss collaborative writing may also support revision of the process, metacognitive reflection, and feelings of group ownership that are conducive to learning gains and transfer. Collaborative writing expects students to engage in a new form of writing that combines coupled and decoupled tasks in unique ways. These new combinations may not fit under the traditional writing process terms used in traditional turn-taking peer review, or even edit-turn group writing. Group ownership can actually develop through the process of developing names for practices adopted by a group (Southavilay, Yacef, Reimann, & Calvo, 2013). Encouraging naming practices for emerging processes could encourage all three desirable outcomes of collaborative writing: process revision

and iteration, metacognition through metalanguage, and group ownership of process. It is possible that if high school collaborative writers discuss and revise their process more directly, the collective target could shift from prioritizing the manuscript to including the collaborative writing process itself.

We saw a tendency in high school collaborative writers to prioritize grades over learning, which was expressed by the writing product or manuscript that would receive the final outcome of a grade. Again, the external evaluation of a grade should not override the individual evaluation of learning gains. It is possible that if high school collaborative writers discussed and revised their process more directly, the collective target could shift from the grade-bound artifact manuscript to the transferable skill of the collaborative writing process itself. Making time for more learners to engage in metacognitive reflection about the collaborative writing process itself should accompany collaborative writing experiences in order to manage this tendency and promote a transfer-oriented approach to collaborative writing.

The field should also anticipate that rates of technological change will only continue. In this regard, educational practitioners should be reminded that high school students learning to write collaboratively for either workplace or higher education demands should maintain an actor-oriented transfer orientation when doing so. Actor-oriented transfer, according to Lobato (2003, 2012), considers how the learner, not the task or context, determines the conditions under which transfer occurs. Consequently, high school writers' feelings of ownership should not be viewed by educators as obstructive. Instead, ownership over collaborative writing process is critical to promoting high school writers' ability to retain and adapt a learner-centered collaborative writing process that will adapt to emerging work environments. By doing so, high school writers retain ownership of their skills rather than rely upon a workspace to initiate their activation.

Limitations

This section will discuss three limitations of the study, which include the teacher as researcher component, the impact of sampling, and the scope of data collection.

The teacher as researcher model adopted in this dissertation project introduced limitations requiring consideration. By pursuing the integration of embedded learning analytics into its empirical evaluation of outcomes, especially in a transferable form, the dissertation study provided amelioration of those influences by taking advantage of current, authentic technologies. Despite this, it is important to note that in practice, the learning analytics themselves did not completely replace teacher as researcher interpretation of students' writing. In an attempt to also address this potential limitation, a more conservative approach of coding phrases as single units of revision rather than character-count based approaches to measuring revision (Faigley & Witte, 1981; Wichmann & Rummel, 2013) was also applied. Still, the limitations of the teacher as researcher model in terms of introduced a degree of interpretation when evaluating the activities and results of the study's participants.

Another limitation is the small sample and setting, which impacts the generalizability of the findings. The study drew participants from one high-performing high school. The study used a quasi-experimental approach that integrated the collaborative writing interventions into a preexisting unit of study in two existent classes. In order to maintain an authentic classroom context, students who were non-participants worked with students participating in the study in collaborative writing groups. Although this does not appear to have affected data collection and analysis for the study's participants, in some cases, non-participating students demonstrated behaviors and attitudes that may have provided additional insight. In particular, clarifying the study's lack of significant results in terms of shifting feelings of ownership may have emerged

from having a greater number of entire, intact groups to analyze.

A more potentially critical limitation developed from the data collection incorporated into the study. Although the instruments included in this study captured the participants' reported experiences, audio or video recordings of their face-to-face discussions may have enabled the study to develop a clearer picture of how high school students engage in developing a process of collaborative writing. The conceptualization of collaborative writing derived from Lowry, Lowry, & Curtis (2003) emphasizes the social processes of collaborative writing that surround and support the negotiation, coordination, and communication between collaborative writers. The side conversations of all students may have provided additional insight into how collaborative writing is socially mediated for high school students. For the treatment group, specifically, no meaningful revisions of the intervention occurred, yet having an empirical view of their attention paid to the process itself may have revealed insights about the factors of time, ease, flexibility, effort, and conflict that emerged from the qualitative analysis of available data. For the control group, iterations of their collaborative writing processes did occur. If negotiation, coordination, and communication are social processes embedded in collaborative writing, then capturing the social mode of face-to-face communication through audio recordings may have yielded additional insight into how high school collaborative writers develop and refine strategies for collaborative writing tasks.

Future Research

Future research should build upon the study's significant outcomes and address the less conclusive collaborative writing outcomes resulting from the revision decision method intervention.

Primarily, a long-term study of how high school collaborative writers perform over more

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extended exposure to collaborative writing with the intervention method would be important to determine its efficacy as a means to deepen revision approaches, especially the revision of the collaborative writing process itself. This would also reinvestigate the role of self- and co-regulation as metacognition over time. Additional experience might also provide enough automaticity with some of the processes embedded in collaborative writing to encourage active discussion and revision of the process to better adjust it according to learners' experiences. Further, it would provide a clearer map of writing contexts for which the method provides students with adequate support in a way that promotes problem-solving, not just puzzle-completing, to better engage with the potential learning outcomes of collaborative writing. A year-long study of a classroom adopting the revision decision method would also permit investigation of whether or not community of practice dynamics are supported within months of experience through iteration of the revision decision method (Team BE, 2011).

Over the course of a long-term study, changing the composition of collaborative writing groups would also enhance the study's design. The study's participants viewed outcomes as grounded in individuals both in terms of how individual differences, not group differences, affected the collaborative writing experience, and how individuals had learning gains. By changing groups, it would be possible to investigate whether or not the same dynamics occurred for individual writers, regardless of group composition. Within this context, considering a sub-group analysis of gender may also be appropriate; Brodahl and Hansen (2014) found male collaborative writers to be more preoccupied with technical difficulties, while females were more concerned about group size. As an extension of group dynamics, the potential for high school collaborative writers to adopt community of practice dynamics as a total community, rather than smaller writing groups, could occur within a long-term study that made changing groups over the

course of the intervention part of its design.

A particular context for further investigation would be to include alternative writing tasks beyond the classroom functional tasks included in this study. More personal or creative modes of writing would affect feelings of ownership, in particular, allowing research to investigate how the method functions within those writing contexts. Since personal ownership towards written product and writing process remains a desirable goal in writing instruction (Elbow, 1981), finding effective ways to experience both individual and shared ownership towards more expressive forms of writing may generate satisfaction and motivation for student writers.

Along with varying the writing task for purpose and audience, investigating the transfer abilities across collaborative writing and independent writing would help educators merge the use of collaborative and independent writing as they pursue general literacy for high school students. This would also investigate whether or not collaborative writing is an effective mode for learning improved peer review processes transferable to traditional independent writing process classroom instruction.

Within the revision decision method itself, investigating alternative ways of promoting reflection about the collaborative writing process would be an additional direction for future research. Asking high school students to review simpler visual versions as a separate reflect step, rather than trying to embed the reflect step in the revision decision method itself, may help to alleviate the burdens on the method resulting from time concerns.

Significance of the Study

This dissertation project evaluated the efficacy and feasibility of an intervention for high school collaborative writing that focused on a cognitively challenging and lucrative element of the writing process: the collaborative revision of collaboratively drafted text. Designing an

intervention to scaffold but not suppress engagement with collaborative writing partners faced complex challenges. However, the participants' ability to reach and maintain an increased level in revision target depth, against the tendency to revert to superficial revision targets by adolescent writers that is well-supported by research, suggests that teachers can begin to pursue the goals of digital literacy that the 21st century demands.

This dissertation project sought investigation of an intervention for collaborative writing that was flexible, manageable, and scalable. The participants themselves demonstrated the ease with which they managed it. The fact that they acknowledged it was a change from business-as-usual yet quickly targeted meaningful work when using it shows that it the method is manageable. The participants described their own ideas for scaling the use of the method depending upon skill level or size of the group. All of these concerns suggest its suitability for classroom adaptation.

This dissertation project also sought to contribute to the professional knowledge base about the usefulness of emergent technologies in real-time revision and editing workspaces for research into writing instruction. The stealthy use of the documents' embedded data supported both ameliorating teacher as researcher effects and avoiding the introduction of confounding variables.

The high school students' own willingness to acknowledge and overcome potential obstacles, to seek constructive conflict also emerged from their willingness to shift feelings of ownership from a personal approach to writing to what they deemed a "professional" approach. The participants understood that in order to write collaboratively, they needed to, as White and Frederiksen (2005) articulated it, wear different hats as those needs arose. Even though this willingness may have made it difficult to reflect on metacognitive growth, they met the challenge

of engaging in constructive conflict. This confirms that in addition to prioritizing their produced writing when articulating learning gains, they also pursued the cognitive outcome of being able to write collaboratively.

Conclusion

High school collaborative writers can be successful. Although it may take more effort to develop them, their metacognitive self- and co- regulation processes can support the pursuit of meaningful and deep writing objectives as a collaborative group. Their social processing of feelings of ownership can be managed by shifting to feeling ownership of collaborative writing instead of only individual writing. Thoughtful scripting can scaffold the negotiation, coordination, and communication required to engage in collaborative writing while managing its multiple processes. Knowing that high school students are developmentally capable of collaborative writing success but developmentally prone to cooperative writing regression, educators should guide high school students towards building appropriate collaborative writing processes. Doing so empowers high school students entering the workplace or higher education with transferable experience and skills in collaborative writing that prepare them for the demands of 21st century literacies.

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List of Appendices

Appendix A: Instructional Materials

The Revision Decision Method Tutorial was described via a PowerPoint presentation.
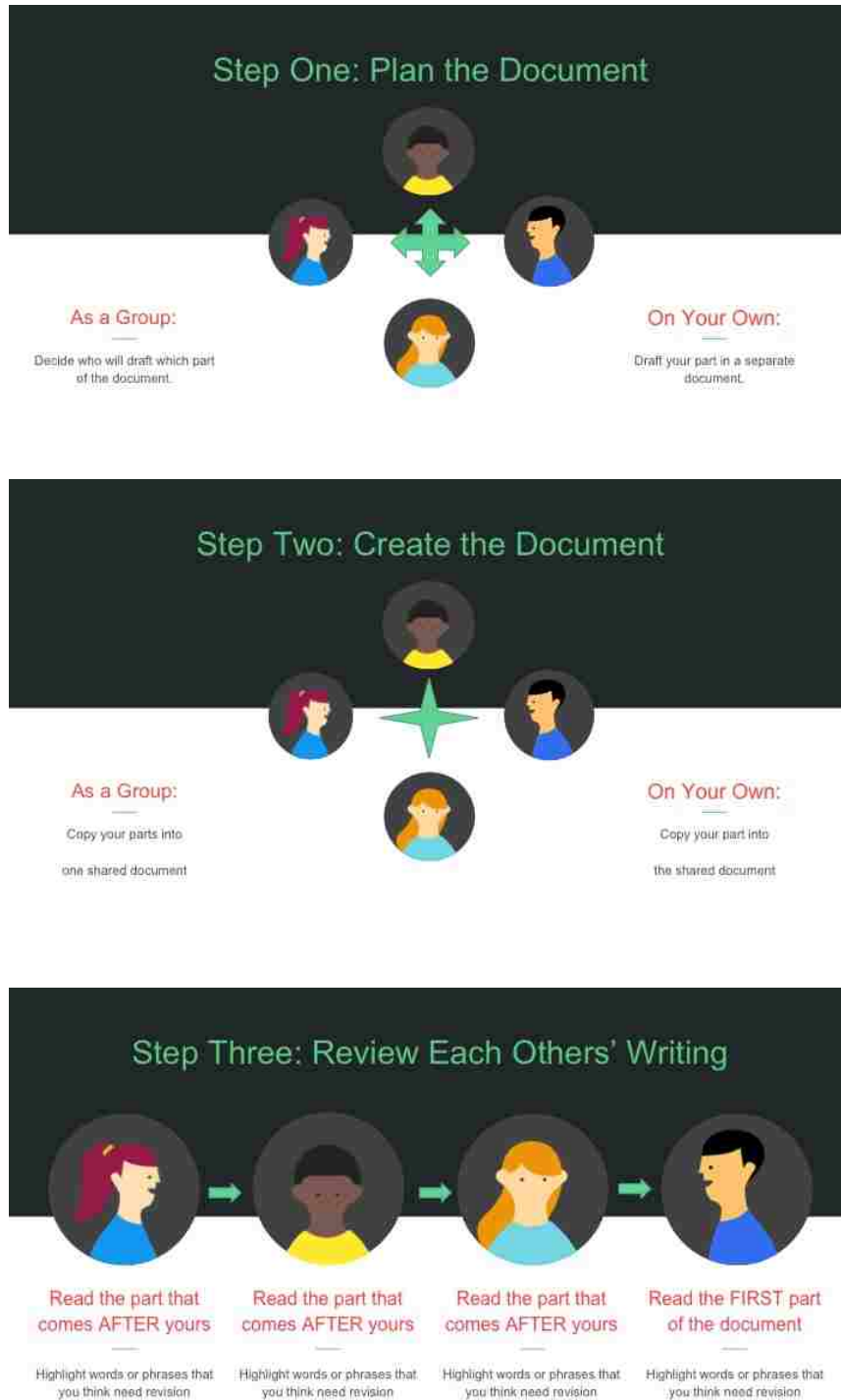
Step Five: Suggest Revisions

Read the next part part that someone highlighted

Start a comment thread that explains what, why, and how a revision should be made there

Read the next part part that someone highlighted

Start a comment thread that explains what, why, and how a revision should be made there

Read the next part part that someone highlighted

Start a comment thread that explains what, why, and how a revision should be made there

Read the next part part that someone highlighted

Start a comment thread that explains what, why, and how a revision should be made there

Step Six: Make Revision Decisions

As a Group:

Start at the beginning.

Read the comment threads together.

Make a revision decision.

On Your Own:

Update the comment threads you started with what your group's final revision decision is. If your group decides to make no revision, that's still a decision.

Last Step: Revise the Document

As a Group:

Follow through with the revision decisions that the group made.

On Your Own:

Update the part that you started comment threads for with the revision decisions the group made.

Summary

Revision Decision Model

❖ Plan the document

❖ Create the document

❖ Review each others' writing

❖ Suggest revisions

❖ Make revision decisions

❖ Revise the document

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Appendix B: Collaborative Writing Tasks

Collaborative Writing Task One (Treatment)

It's time to plan your group's literature circle syllabus.

Please submit a group syllabus proposal that achieves the following goals:

1. Identifies what you will read for every discussion date.
2. Justifies your selection of these stories and/or sections for your group's syllabus.
3. Evaluates how well your other literature circle reading selections have gone up to this point in the year. Which reading selections have been successful? Which selections have not been as successful?

Your group's syllabus will be based upon how well your group justifies your selection of stories and/or sections.

Collaborative Writing Task Two (Treatment)

It's time to plan your group's next literature circle discussion.

Please submit a group evaluation proposal that achieves the following goals:

1. Describes features of a good literature circle discussion.
2. Describes pitfalls to avoid in a literature circle discussion.
3. Evaluates how well your literature circle group's discussions have been going so far. What's gone well? What could be improved?

Your group's discussion will be evaluated based upon how well your group demonstrates the features and avoids the pitfalls you describe.

Use the revision decision method as you finalize your group's proposal.

Collaborative Writing Task Three (Treatment)

It's time to plan your group's next literature circle discussion.

Please submit a group discussion proposal that achieves the following goals:

1. Describes enough roles for every member of your group to actively contribute to the next literature circle discussion.
2. Describes what the roles will prepare before the discussion.

3. Describes what actions the roles will perform during the discussion.
4. Justifies your proposed roles in terms of how they will promote a good literature circle discussion.

Your group's completion of these roles will be evaluated based upon how well your group members prepare and perform according to your role descriptions.

Use the revision decision method as you finalize your group's proposal.

Collaborative Writing Task One (Control)

It's time to plan your group's literature circle syllabus.

Please submit a group syllabus proposal that achieves the following goals:

1. Identifies what you will read for every discussion date.
2. Justifies your selection of these stories and/or sections for your group's syllabus.
3. Evaluates how well your other literature circle reading selections have gone up to this point in the year. Which reading selections have been successful? Which selections have not been as successful?

Your group's syllabus will be based upon how well your group justifies your selection of stories and/or sections.

Collaborative Writing Task Two (Control)

It's time to plan your group's next literature circle discussion.

Please submit a group evaluation proposal that achieves the following goals:

1. Describes features of a good literature circle discussion.
2. Describes pitfalls to avoid in a literature circle discussion.
3. Evaluates how well your literature circle group's discussions have been going so far. What's gone well? What could be improved?

Your group's discussion will be evaluated based upon how well your group demonstrates the features and avoids the pitfalls you describe.

Collaborative Writing Task Three (Control)

It's time to plan your group's next literature circle discussion.

Please submit a group discussion proposal that achieves the following goals:

1. Describes enough roles for every member of your group to actively contribute to the next literature circle discussion.
2. Describes what the roles will prepare before the discussion.
3. Describes what actions the roles will perform during the discussion.
4. Justifies your proposed roles in terms of how they will promote a good literature circle discussion.

Your group's completion of these roles will be evaluated based upon how well your group members prepare and perform according to your role descriptions.

Appendix C: Straw Document for Practice Task

Here are the directions that were provided to the collaborative writing group:

It's time to plan your group's next Socratic seminar discussion.
Please submit a group discussion proposal that achieves the following goals:

1. *Describes ground rules you would like to follow during the Socratic seminar.*
2. *Describes what people will prepare before the discussion.*
3. *Describes how seminar participants will be evaluated.*
4. *Justifies your proposed ground rules, preparation directions, and evaluation plan in terms of how they will promote a good Socratic seminar.*

Your upcoming Socratic seminar will be evaluated based upon how well you prepare and perform according to your descriptions.

Here is the proposal submitted the collaborative writing group submitted:

We think nobody should talk more than once because they might talk too much and nobody else will have a chance to talk during the seminar. That happened before, and we don't want it to happen again. We also think that people should only include one quotation during the whole seminar. Sometimes, it feels like people say quotes just because their supposed to. It's okay to say a quote, but too many is too much. This will promote a good seminar because it won't get boring to listen to.

We think that preparation for the seminar is important. All seminar participants should bring a printed copy of the materials scheduled for discussion. Additionally, all seminar participants should have read the materials and made annotations of their reactions to those materials. Most importantly, every seminar participant should prepare a thoughtful question that encourages critical thinking and close reading of a significant passage in the seminar text. To avoid distraction, these materials should be printed rather than opened up on a phone or other device. This will promote a good seminar because people will be ready to share ideas and answer questions.

We think seminar participants should be evaluated by an outer circle. Too many people in the same seminar makes it harder to talk, and if some people sit out, they can listen and give feedback to people who are in the discussion. The outer circle will have a checklist, and they can say whether or not a person completes all of those things on the checklist. The checklist should have these things on it:

1. Quotes the text once
2. Shows close reading
3. Asks a thoughtful question once
4. Responds to one question
5. Responds to another, different question
6. Responds to a question by asking a follow-up question
7. Gets other people involved in the discussion

This will promote a good seminar because people will not be stressed out about what to do.

The following 6+1 Trait Writing Model rubrics from Education Northwest are available at: http://educationnorthwest.org/

Traits Rubric for Conventions: Grades 3–12

Key question: How much editing is required before the piece can be shared as a final product?
(Note: For the trait of conventions, grade level matters. Expectations should be based on grade level and include only skills that have been taught.)

	Not proficient			Proficient		
	1 Beginning	2 Emerging	3 Developing	4 Capable	5 Experienced	6 Exceptional
	Contains errors in conventions that distract the reader, making text unreadable	Has many types of convention errors scattered throughout text	Handles conventions well at times but, at others, makes errors that distract the reader and impair readability; displays a lack of skill with particular convention(s) through repeated mistakes	Applies standard grade-level conventions accurately on most occasions	Shows few errors with only minor editing needed to publish; may stretch, trying more complex tasks in conventions	Uses conventions effortlessly without significant errors; may use conventions to creatively enhance message
A. Spelling	Has frequent spelling errors, even with common words	Uses phonetic spelling with many errors	Frequently spells simple words incorrectly, although reader can still understand the meaning	Usually uses correct or reasonably phonetic spelling for common grade-level words; may be inaccurate with more difficult words	Correctly spells most common grade-level words and often more difficult words	Has mostly correct spelling, even for more difficult words; includes occasional errors that do not detract from overall quality
B. Punctuation	Uses missing or incorrect punctuation nearly all the time	May have punctuation present but it is usually incorrect	Features simple end punctuation (e.g., period, question mark, exclamation point) that is correct, but internal punctuation (e.g., comma, apostrophe, semicolon) is often missing or wrong	Uses correct end punctuation with only minor errors; contains internal punctuation that is usually correct	Has punctuation that is almost always correct and guides reader through the piece	Includes correct punctuation that enhances readability; may use creative punctuation when appropriate
C. Capitalization	Has capitalization that is random, inconsistent, and sometimes nonexistent	Applies only the most basic capitalization rules correctly	Has capitalization that shows frequent errors except for proper nouns and sentence beginnings	Uses correct capitalization in most cases	Includes correct capitalization consistently	Includes correct capitalization consistently and may employ more sophisticated capitalization for effect

Traits Rubric for Conventions: Grades 3–12

Key question: How much editing is required before the piece can be shared as a final product?
(Note: For the trait of conventions, grade level matters. Expectations should be based on grade level and include only skills that have been taught.)

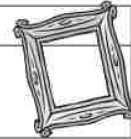|	Not proficient			Proficient		
	1 Beginning	2 Emerging	3 Developing	4 Capable	5 Experienced	6 Exceptional
D. Grammar/usage	Frequently includes noticeable errors in grammar/usage, making writing incomprehensible	Has serious grammar/usage problems of many types that make comprehension difficult	Relies heavily on conversational oral language that results in inappropriate grammar/usage; errors sometimes distract the reader	Employs proper grammar/usage fairly consistently; problems are not serious enough to distort meaning or distract the reader	Includes correct grammar/usage; shows few grammar mistakes and has meaning that is clear	Uses correct grammar that contributes to clarity and style; enhances meaning by sophisticated grammar/usage
E. Editing needed	Requires extensive editing (i.e., on virtually every line) for meaning and publication; reader must read once to decode, then again for meaning	Requires much editing, making publication a time-consuming challenge; meaning is often unclear	Still needs too much editing to publish without multiple redrafts, although meaning begins to emerge	Needs moderate editing to publish; has clear meaning	Requires only some minor editing before publishing; has conventions that are more often correct than not; easily communicates meaning	Needs almost no editing to publish; author may successfully manipulate conventions for stylistic effect
F. Bibliography (optional)	Does not cite works or basic bibliographic information; if included, is unrecognizable	Attempts to cite works and include basic bibliographic information, but these are variable or random	Uses citations and basic bibliographic information inconsistently and/or incompletely in placement and format	Usually cites works and uses basic bibliographic information in correct format	Almost always cites works and uses basic bibliographic information in correct format	Consistently uses correct format to cite works and includes basic bibliographic information with only minor errors

Traits Rubric for Organization: Grades 3–12

Key question:
Does the organizational structure enhance the ideas and make them easier to understand?

	Not proficient			Proficient		
	1 Beginning	**2 Emerging**	**3 Developing**	**4 Capable**	**5 Experienced**	**6 Exceptional**
	Doesn't use identifiable organization; writing lacks a sense of direction or seems random	Contains mostly ineffective organization with only occasional sections or passages that direct the reader	Has uneven organization that affects the reader's ability to follow text	Has basic organization that moves the reader through the text logically without confusion	Reflects smooth and cohesive organization and varied techniques that build smoothly from one idea to the next to create a unified whole	Uses seamless organization that enhances and showcases central ideas; orders or structures information in a compelling way; clarifies relationships among ideas
A. Lead and conclusion	Has no lead or conclusion	Contains a lead or conclusion, which is unclear or ineffective	Includes a lead that doesn't adequately establish purpose and/or a conclusion that fails to provide closure, leaving the reader with questions	Contains a recognizable lead and conclusion but they may be formulaic or obvious	Features a lead that creates anticipation and a conclusion that ties up loose ends with a satisfying sense of closure	Has an inviting lead that draws reader in and creates a strong sense of anticipation; includes satisfying conclusion that conveys a powerful sense of closure and resolution
B. Transitions	Does not include transitions	Uses weak transitions sporadically that fail to connect ideas or minimize confusion	Uses transitions inappropriately, resulting in weak chunking of paragraphs or ideas	Includes transitions that connect ideas though they may be formulaic or predictable in places; has paragraphs with topic sentences and support	Features logical, varied transitions; uses sequence and transition words/phrases effectively; orders paragraphs to support development of ideas	Uses clear, thoughtful transitions, showing the reader how ideas relate and enhancing meaning and progress throughout the piece; includes paragraphs that ensure ideas build throughout the piece to create a unified whole
C. Sequencing	Has no evident sequencing of ideas	Has ineffective sequencing, making it difficult to see how the piece fits together as a whole	Includes sequencing that fails to showcase ideas or takes over so completely it is formulaic	Provides logical and helpful sequencing with ideas placed in an understandable order	Employs sequencing that moves beyond the obvious, building connections between ideas	Uses highly effective sequencing, making best choices for progression and enriching the reader's understanding

Traits Rubric for Organization: Grades 3–12

Key question:
Does the organizational structure enhance the ideas and make them easier to understand?

	Not proficient			Proficient		
	1 Beginning	**2 Emerging**	**3 Developing**	**4 Capable**	**5 Experienced**	**6 Exceptional**
D. Pacing	Has no evident pacing	Has very uneven pacing that slows when the reader wants to move quickly, and vice versa	Appropriately controls pacing in some sections but not in others	Evenly controls pacing in nearly all places	Has well-controlled pacing throughout	Uses pacing skillfully to compel the reader through the piece and enhance its power
E. Purpose/text structure	Leaves the reader struggling to find purpose because of missing text	Has loose text structure that leaves reader unclear or confused about purpose	Uses text structure that reflects purpose in places, but distracts in others	Has text structure that works to communicate purpose but may not enhance understanding	Includes text structure that supports and clarifies purpose for the reader	Uses text structure that flows so smoothly reader hardly notices; uses structure that enhances understanding of purpose
F. Title (optional)	Has no title or a misleading one	Has a title that doesn't match content well	Includes a title that is formulaic or nondescriptive	Creates a title that connects to the central theme	Uses a title that reflects content in an unusual or interesting way	Draws the reader in with a title that is original and captures deeper meaning

Traits Rubric for Presentation: Grades 3–12

Key question:
Is the finished piece easy to read, polished in presentation, and pleasing to the eye?

	Not proficient			Proficient		
	1 Beginning	2 Emerging	3 Developing	4 Capable	5 Experienced	6 Exceptional
	Uses presentation or formatting that makes text unreadable or confusing	Often uses presentation or formatting that makes text confusing	Has uneven presentation or formatting that makes text sometimes difficult to read or understand; piece lacks a finished appearance	Uses presentation or formatting that supports a clear message; piece appears finished and sufficiently polished	Creates presentation or formatting that makes text generally easy to read with a pleasing appearance that enhances understanding	Has professional–looking presentation or formatting; makes choices to enhance meaning
A. Font style/size	Includes many font styles/sizes that make piece unreadable or are completely inappropriate for the purpose	Uses multiple font styles/sizes that make piece hard to read or understand	Has font styles/sizes that are inconsistent or poorly chosen in places, creating an obstacle to reading or understanding	Uses font styles/sizes consistently so piece is easy to read and understand	Has font styles/sizes that are consistent and appropriately chosen, supporting understanding and readability	Selects font styles/sizes that enhance readability and support the meaning of the text; chooses font styles intentionally to match the purpose of the text
B. White space	Does not consider white space, so use is random and confusing; makes it difficult to identify beginning and ending text	Shows emerging use of white space, though piece seems arbitrarily placed on paper with few intentional margins or boundaries	Uses white space to frame and balance piece but is inconsistent; has margins, though some text may crowd edges, and uses uneven indenting	Uses white space to frame text by creating reasonable margins; consistently indents or blocks paragraphs	Features white space that helps reader focus on text; uses margins to frame piece and other white space to set off graphics and text features; indents or blocks paragraphs	Uses white space to optimally frame and balance text with graphics and text features; indents or blocks paragraphs; may include creative use of space to highlight important details
C. Text features (optional)	Has no text features	Attempts to include text features but they don't appear to have a purpose, so are mostly inappropriate and ineffective	Uses text features that are frequently ineffective for organizing or clarifying the piece	Includes text features (e.g., titles, bullets, page numbers, subheads) that usually organize and clarify ideas	Incorporates text features that serve to integrate ideas, articulate meaning of piece, and make it easier to read	Uses text features that help reader extend meaning of piece and develop more complete understanding

Traits Rubric for Presentation: Grades 3–12

Key question:
Is the finished piece easy to read, polished in presentation, and pleasing to the eye?

	Not proficient			Proficient		
	1 Beginning	2 Emerging	3 Developing	4 Capable	5 Experienced	6 Exceptional
D. Visuals and graphics (optional)	Uses visuals/graphics that are incomprehensible and/or unrelated to text	Chooses visuals/graphics that are only topically related to the text and don't enhance understanding	Uses visuals/graphics that match and support text in some instances, with effort on the reader's part	Includes visuals/graphics that support text	Features visuals/graphics that support and consistently clarify text through placement and description	Creates visuals/graphics that help enrich and extend meaning and are integrated to enhance understanding of the text
E. Handwriting (optional)	Forms handwritten letters inconsistently or incorrectly, making piece unreadable; uses spacing of letters and words that is unbalanced or absent so the piece is mostly illegible	Uses irregular letter shape and form so handwritten letters and words are often unreadable; includes spacing that is often inconsistent, further complicating readability	Has handwriting that occasionally impairs readability; uses inconsistent spacing in places	Uses correct and readable handwriting; has spacing of letters and words that is generally consistent	Features neat and readable handwriting; has uniform spacing between letters and words	Shows handwriting that is pleasing to the eye; uses uniform spacing and lettering

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Traits Rubric for Ideas: Grades 3–12

Key question:
Does the writer engage the reader with fresh information or perspective on a focused topic?

	Not proficient			Proficient		
	1 Beginning	**2 Emerging**	**3 Developing**	**4 Capable**	**5 Experienced**	**6 Exceptional**
	Does not reflect a main idea or purpose; includes content that is off topic	Has a main idea that begins to emerge, but author's direction is unclear	States or implies a main idea, but is unclear, unfocused, inaccurate, and/or underdeveloped	Conveys a a clear, focused, and accurate main idea with adequate development and/or support	Produces a clear, focused, accurate, and complex main idea with convincing development and/or support	Conveys a clear, focused, accurate, and significant main idea and includes unique, substantial insights that are fully developed and supported
A. Main idea	Does not convey a main idea or topic	Focuses on a general topic but does not suggest a main idea	Suggests a main idea, but the direction of the piece is still unclear	Has a clear, focused main idea	Conveys a clear, focused, and substantive main idea	Conveys a clear, focused, substantive, and original main idea that drives the piece
B. Details and support	Does not develop or support a main idea	Attempts to develop or support the main idea with limited, repetitious, faulty, and/or unclear information and/or details	Provides incidental support of the main idea with information that lacks specificity and relevance and may be inaccurate; may include some generic details

In A/O writing at grade 7+, includes one or more counterclaims that are acknowledged but not addressed | Develops the main idea with generally accurate and relevant supportive information and/or details

In A/O writing at grade 7+, addresses one or more counterclaims | Develops the main idea with specific, relevant, accurate information and/or some vivid details

In A/O writing at grade 7+, addresses and thoroughly examines counterclaims | Develops the main idea with convincing, supportive information and/or concrete details that go beyond the obvious

In A/O writing at grade 7+, thoroughly examines counterclaims and addresses them in original ways that enrich the author's claim |
| **C. Reasoning/ thinking** | Does not show author's thinking in developing or connecting ideas | Generalizes about the topic without providing logical connections among ideas, or uses connections that are faulty | Begins to develop supporting ideas, some of which lack clarity or obvious logical connection | Presents useful information that helps the reader understand the author's reasoning, logic, or perspective | Presents useful, fresh information or perspective with logical reasoning that clarifies complex ideas | Conveys fresh, useful information using higher order thinking skills and convincing reasoning to provide unique insights into complex ideas |

Traits Rubric for Ideas: Grades 3–12

Key question:
Does the writer engage the reader with fresh information or perspective on a focused topic?

	Not proficient			Proficient		
	1 Beginning	**2 Emerging**	**3 Developing**	**4 Capable**	**5 Experienced**	**6 Exceptional**
D. Evidence selection and acknowledgment	Contains no or incorrect evidence from sources; likely plagiarizes support	Has vague, imprecise, and/or weakly integrated evidence without attribution or acknowledgment of sources; likely plagiarizes at least some support	Has weakly integrated and/or incomplete evidence; contains general attribution or acknowledgment (if any); may appear to include plagiarized support	Provides adequate evidence from sources with proper attribution or acknowledgment	Integrates strong evidence from sources with proper attribution or acknowledgment	Includes comprehensive evidence from sources that is smoothly integrated and includes proper attribution or acknowledgment
E. Awareness/ engagement of reader	Does not appear to have the reader in mind	Shares information but does not anticipate what the reader knows or believes	Attempts to engage reader; however, important questions remain that may cloud the reader's understanding	Engages reader in exploring ideas and answers questions critical for understanding	Knows audience and anticipates and addresses the reader's knowledge, questions, and possible biases	Engages audience on multiple levels, anticipating the reader's knowledge and biases and answering all critical questions

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Traits Rubric for Word Choice: Grades 3–12

Key question:
Does the author's choice of words convey precise and compelling meaning and/or create a vivid picture for the reader?

	Not proficient			Proficient		
	1 Beginning	2 Emerging	3 Developing	4 Capable	5 Experienced	6 Exceptional
	Uses limited vocabulary; attempts to use words to convey meaning are unsuccessful	Has flawed or simplistic vocabulary, resulting in impaired meaning; reader has difficulty understanding the message	Has vocabulary that is understandable yet lacks energy and imagination; some interpretation may be needed to understand parts of the piece	Uses vocabulary that is functional and achieves purpose, with some imagery and/or unique word choices; author's meaning is easy to understand and fits audience and text type	Incorporates precise and appropriate vocabulary; uses imagery and/or figurative language; features writing appropriate to audience, purpose, and text type	Creates vivid imagery, with powerful and engaging vocabulary; uses precise words and/or figurative language to enhance meaning in interesting, natural ways
A. Word meaning	Uses vocabulary that is so broad, generic, and/or inaccurate, it fails to communicate a message	Uses vocabulary that is so vague and mundane that the message is limited and unclear (e.g., "good," "bad," "nice")	Employs vocabulary that is correct in a general sense; includes message that is emerging or can be inferred; uses limited or inaccurate domain-specific vocabulary	Features vocabulary that works to clarify meaning/purpose and begins to shape a unique piece; has message that's easy to identify; uses accurate domain-specific vocabulary	Has vocabulary that suits purpose well and clearly communicates message; uses domain-specific vocabulary appropriately to demonstrate author's understanding	Features precise, accurate vocabulary, chosen to enhance purpose and meaning; has author's message that's easy to understand; uses domain-specific vocabulary professionally
B. Word quality	Has vague vocabulary so words convey no clear message	Uses confusing or misleading vocabulary and includes incorrect usage of even simple words; creates no images	Includes very basic vocabulary; uses words that tend to "tell" not "show"; has few images	Features vocabulary comprising familiar words and phrases that communicate clearly but only show a moment or two of sparkle or imagery	Has strong vocabulary that makes it easy to "see" what the author is trying to convey; employs vivid and/or figurative language	Uses striking, powerful, and engaging vocabulary that captures reader's imagination and lingers in the mind; enhances recall of significant phrases or mental images

Traits Rubric for Word Choice: Grades 3–12

Key question:
Does the author's choice of words convey precise and compelling meaning and/or create a vivid picture for the reader?

	Not proficient			Proficient		
	1 Beginning	2 Emerging	3 Developing	4 Capable	5 Experienced	6 Exceptional
C. Word usage	Uses words incorrectly, making message unclear; distracts reader with errors and frequently uses slang and/or texting language that are inappropriate	Uses words that are inappropriate (i.e., either too plain or so exaggerated that they impede understanding); includes slang and/or texting language that do not suit purpose	Chooses words that are functional but limited, conveying only a basic message; occasionally includes slang and/or texting language that are inappropriate	Demonstrates willingness to stretch and grow with attempts at creative word choice; shows mastery of appropriate vocabulary for message, purpose, and audience	Frequently chooses creative, precise words to clarify and enhance meaning	Uses words that are natural, original, and suited to purpose and audience; features effective word choice that enriches the author's message
D. Grammar	Misuses parts of speech frequently, confusing reader and clouding the message	Has limited variety in parts of speech; uses jargon or clichés that detract from the message	Includes mechanical parts of speech that reflect a lack of craftsmanship; relies on passive verbs, overused nouns, and lack of modifiers that limit the message and make the piece uninteresting	Uses accurate and occasionally refined parts of speech that are functional and start to shape the message	Carefully chooses correct and varied parts of speech to effectively communicate message and clarify and enrich writing	Crafts parts of speech to best convey message; has lively verbs that energize the piece and precise nouns/modifiers that add depth, color, and specificity

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Traits Rubric for Sentence Fluency: Grades 3–12

Key question:
Does the author control sentences so the piece flows smoothly when read aloud?

	Not proficient			Proficient		
	1 Beginning	**2 Emerging**	**3 Developing**	**4 Capable**	**5 Experienced**	**6 Exceptional**
	Structures sentences incorrectly so reader has to reread piece several times and still has difficulty reading aloud without pausing or substituting phrases	Varies sentences very little; uses even simple sentence structure incorrectly in places, causing reader to stumble when reading aloud	Has sentences that are technically correct but not varied, creating sing-song patterns or lulling the reader to sleep; sounds mechanical when read aloud	Has varied sentences that flow smoothly; tends to be pleasant or businesslike, though may still be mechanical in places; is easy to read aloud	Incorporates some sentences that are rhythmic and flowing, using a variety of correctly structured sentence types; flows well when read aloud	Uses sentences that flow, have rhythm and cadence, and are well built, with strong, varied structures that invite expressive oral reading
A. Sentence structure	Has choppy sentence structure that is incomplete, run-on, rambling, or awkward; determining where sentences begin and end is nearly impossible	Uses sentence structure that often works, but may be overly simplistic for the purpose	Uses technically correct sentence structure, yet sentences are frequently not smooth	Uses sentence structure that is correct and smooth, but mechanical in places; sentences hang together and are structurally sound	Has sentence structure that flows well and moves reader fluidly through the piece	Uses strong sentence structure, underscoring and enhancing meaning while engaging and moving the reader fluidly from beginning to end
B. Sentence sense and rhythm	Has no apparent sentence sense, making it nearly impossible to determine where sentences begin and end; has choppy rhythm; piece cannot be read aloud without author's help, even with practice	Shows little evidence of sentence sense; requires reader to reconstruct sentences to make them flow correctly; does not invite expressive oral reading	Uses inconsistent sentence sense; enables reader to read aloud after a few rereadings	Has evident sentence sense; rhythm is present; most sentences lend themselves to oral reading	Conveys sentence sense that is strong, with frequent rhythmic patterns; uses construction and variety to enhance flow; employs dialogue or fragments effectively; reader can read aloud easily	Has strong sentence sense with rhythm and cadence; has structure that contributes to meaning; may use dialogue that sounds natural and fragments that add style; reading aloud is expressive and pleasurable

Traits Rubric for Sentence Fluency: Grades 3–12

Key question:
Does the author control sentences so the piece flows smoothly when read aloud?

	Not proficient			Proficient		
	1 Beginning	**2 Emerging**	**3 Developing**	**4 Capable**	**5 Experienced**	**6 Exceptional**
C. Sentence variety	Has incomplete sentences that make it hard to determine quality of beginnings or identify type of sentence	Uses simple sentences (i.e., subject-verb-object) that mostly begin the same way and are monotonous	Includes sentence beginnings that sometimes vary, but in a predictable way; limits almost all sentences to simple and compound types	Varies sentence beginnings yet many are routine or generic; includes simple, compound, and a few complex sentence types	Has varied and frequently unique sentence beginnings; uses a variety of sentence types (e.g., simple, compound, complex, and compound-complex) to create balance	Adds interest and energy with varied sentence beginnings; uses a variety of sentence types that appear chosen to enhance meaning and flow
D. Connecting sentences	Has weak or no transitions that create a jumble of choppy language and/or run-on sentences; uses sentences that muddle the sound of the piece	Incorporates basic transitions (e.g., and, so, but, then, because) that do little to lead the reader through the piece; if used, transitions seem randomly applied	Leads reader from sentence to sentence with a few, simple transitional words or phrases, though coherence remains limited	Holds piece together with varied transitional words or phrases (e.g., either, therefore, although)	Moves reader easily through the piece with thoughtful and varied transitional words or phrases	Uses creative, appropriate, and varied transitional words or phrases that show how each idea relates to the previous one and tie the piece together

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Traits Rubric for Voice: Grades 3–12

Key question:
Does the reader clearly hear this writer speaking in the piece?

	Not proficient			Proficient		
	1 Beginning	2 Emerging	3 Developing	4 Capable	5 Experienced	6 Exceptional
D. Commitment	Has no commitment to topic; contains lifeless writing	Has minimal commitment to topic; does not help the reader feel anything or understand topic better	Shows an emerging commitment to the topic, though the reader is not convinced that the author cares about topic	Presents a commitment to the topic; author's point of view emerges in places but may periodically lapse into vague generalities, detracting from impact	Has a clear and focused commitment to the topic; author's enthusiasm is catching	Conveys a strong commitment to topic; author's passion is clear and compelling, prompting the reader to want to know more
E. Fit with audience/purpose	Has no discernible voice	Uses voice that does not support or is inappropriate for the purpose (e.g., sarcasm, incongruous humor) Narrative is lifeless; I/E or A/O writing lacks conviction or authority to set it apart from a mere list of facts	Has a voice that is starting to support purpose, though it remains mostly weak; may have an inconsistent point of view	Includes a voice that supports purpose but frequently lacks spark; has consistent point of view Narrative is sincere; I/E or A/O writing establishes credibility at moments but not consistently	Uses a voice that supports author's purpose and a point of view that enhances the piece Narrative entertains or engages reader; I/E or A/O writing reveals why author cares about the topic and chose these ideas	Has a voice that enhances purpose and is engaging, passionate, enthusiastic, and at times creative; has a distinct point of view that clarifies meaning of the piece

Traits Rubric for Voice: Grades 3–12

Key question:
Does the reader clearly hear this writer speaking in the piece?

	Not proficient			Proficient		
	1 Beginning	2 Emerging	3 Developing	4 Capable	5 Experienced	6 Exceptional
	Appears the author is indifferent, uninvolved, or distanced from the topic, purpose, and/or audience	Relies on simplistic phrases such as "I like it" or "It was fun" to convey any personal quality	Has an emerging voice that is not distinct or unique; gives the reader an incomplete impression of the author's relationship to the purpose and topic	Portrays the author as sincere, yet not fully engaged or involved; offers a pleasant or even personable voice, though reader is not completely convinced of the author's commitment to the topic	Addresses topic, purpose, and audience in a sincere and engaging way that convinces the reader of the author's commitment to the topic	Addresses the reader in an individual and engaging way that shows ownership of purpose and topic; is respectful of audience and/or purpose
A. Engagement with reader	Disengages reader with flat writing; has no content that interacts with the reader in any way	Follows a predictable approach with nothing fresh to engage the reader	Seems aware of the reader, yet writing avoids original insights, preferring safe generalities	Begins to reach audience and has moments of successful interaction	Communicates with reader in an earnest, pleasing, authentic manner	Interacts with and engages the reader in ways that reveal the author's own personality, making unique choices to reach the audience
B. Individual expression	Reveals virtually nothing specific about the author, making this a piece that anyone could have written	Offers glimpses of original thinking but is mostly flat, revealing little of the author's perspective	Surprises the reader with occasional "aha" moments but shows minimal risk-taking	Surprises, delights, or moves reader in more than one or two places	Has moments of insight and risk-taking that strengthen the piece	Reveals individual thinking in a committed, distinctive manner that helps the reader "hear" this author
C. Tone	Has no evident tone	Has a tone that does not support the purpose	Conveys a flat, disinterested tone	Includes tone that begins to support and enrich the writing and clarify the message	Uses tone that supports the message and purpose most of the time	Employs tone that gives flavor and texture to message and is appropriate to both the author and purpose

LEHIGH
U N I V E R S I T Y®

PARENTAL CONSENT FORM
Collaborative Writing with a Revision Decision Method

This form is to request your permission for your child to participate in a research study on Supporting collaborative writing in secondary Language Arts: A revision decision method intervention. Your child was selected as a possible participant because of his/her participation in collaborative writing during English Language Arts class. With collaborative writing becoming more common in education and the workplace, this study seeks to understand how students write collaboratively (for example, what strategies do they use) and ways in which teachers can support the collaborative writing process to help improve students' 21st century literacies.

This study is being conducted by: Daria Kuscenko, doctoral student in the College of Education, Lehigh University under the direction of Dr. Brook Sawyer, assistant professor, College of Education, Lehigh University.

Your child's participation is voluntary. Because your child is a minor, your consent is required before your child may participate. Please note that your child will also be asked to indicate whether he/she is willing to participate. Your permission and your child's permission is both needed for your child to participate.

Please consider the information carefully. Feel free to ask questions before making your decision about whether or not your child may participate. If you consent to your child's participation, please sign this form. You will receive a copy of the form.

The purpose of the study is to learn how students write collaboratively and to examine a teaching strategy that may support the collaborative writing process to help improve students' writing overall.

Procedures
All students will participate in collaborative writing assignments that are part of regular instruction during English Language Arts class. Students may also participate in a short, audiotaped interview about their experiences during the writing tasks. Students will complete several brief questionnaires on their beliefs about writing and demographics.

The collaborative writing tasks that all students will participate in will take approximately 3 class periods, or 2 hours. Study participants' involvement will take approximately 1 additional hour to complete interviews.

Risks and *Benefits* of being in the study

Possible Risks:

There are minimal risks associated with this study. Your child may experience discomfort being observed or during the interview. Your child may stop participating at any time at which he/she feels too uncomfortable to continue.

The benefits to participation are:

There are no direct benefits to your child for participating, although he/she may learn something about his/her writing style as a result of participation. Your child's participation will make an important contribution to learning more about students' writing styles, which can lead to improved teaching practices.

Confidentiality

Any data or answers to questions will remain confidential with regard to you or your child's identity. Any information collected through this research project that personally identifies your child will not be voluntarily released or disclosed without your separate consent, except as specifically required by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a participant. Research records will be stored securely and only researchers will have access to the records. If you grant permission for your child to be audiotaped, audiotapes will also be stored securely on password-protected servers for a minimum of three years and then destroyed. Audiotapes will not be used for educational purposes.

Voluntary Nature of the Study

Participation in this study is voluntary:

Your decision whether or not to participate will not affect your current or future relations with Lehigh University or your child's high school. Your child is free to not answer any question or withdraw at any time without affecting these relationships. If you or your child decide to stop participation in the study, there will be no penalty and neither you or your child will lose any benefits to which you are otherwise entitled.

Contacts and Questions

The researcher conducting this study is:

Daria Kuscenko. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact through Daria Kuscenko, Lehigh University, dak410@Lehigh.EDU or 908-204-2585. You may also contact Dr. Brook Sawyer at brooksawyer@lehigh.edu or 610-758-3236.

Questions or Concerns:

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact Naomi Coll at (610)758-2985 (email: nac314@lehigh.edu) of Lehigh University's Office of Research and Sponsored Programs. All reports or correspondence will be kept confidential.

Statement of Consent

I have read the above information. I have had the opportunity to ask questions and have my questions answered.

Please check one of the three boxes below in regard to whether you permit your child to participate in the research study and whether or not he or she may be audiotaped. Please complete all of the requested information.

YES, I voluntarily agree to permit my child to participate in this project <u>and</u> to be audiotaped.

_____
Printed name of subject (child)

YES, I voluntarily agree to permit my child to participate in this project, but <u>not</u> to be audtiotaped.

_____
Printed name of subject (child)

NO, I do not want my child to participate in this project.

_____
Printed name of subject (child)

STUDENT ASSENT FORM

Collaborative Writing with a Revision Decision Method

This form is to request your agreement to participate in the research study on Supporting collaborative writing in secondary English Language Arts: A revision decision method intervention. You have been selected as a possible participant because of your participation in collaborative writing. With collaborative writing becoming more common in education and the workplace, this study seeks to understand how students write collaboratively (for example, what strategies do they use) and ways in which teachers can support the collaborative writing process to help improve students' 21st century digital literacies.

This study is being conducted by: Daria Kuscenko, Lehigh University College of Education Graduate Student, under the direction of Dr. Brook Sawyer, Lehigh University College of Education.

Your participation is voluntary. Because you are a minor, parental consent is also required before you may participate. Please note that your parent(s) will be asked to indicate whether you have parental consent to participate. Please consider the information carefully. Feel free to ask questions before making your decision about whether or not you may participate. If you consent to participation, please sign this form. You will receive a copy of the form.

The purpose of the study is to learn how students write collaboratively and to examine a teaching strategy that may support the collaborative writing process to help improve students' writing overall.

Procedures
You will participate in a collaborative writing assignment as part of regular classroom activities. You may also participate in a short, audiotaped interview about your experiences during the two writing tasks. You will complete several brief questionnaires on your beliefs about writing, and demographics.

The collaborative writing tasks that all students will participate in will take approximately 3 class periods, or 2 hours. As a study participant, 1 interview will take approximately 1 additional hour to complete.

Risks and *Benefits* of being in the study
Possible Risks:
There are minimal risks associated with this study. You may experience discomfort being observed or during the interview. You may stop participating at any time you feel too uncomfortable to continue.

The benefits to participation are:
There are no direct benefits to you for participating, although you may learn something about your writing style as a result of participation. Your participation will make an important contribution to learning more about students' collaborative writing styles, which can lead to improved teaching practices.

Confidentiality

Any data or answers to questions will remain confidential with regard to your identity. Any information collected through this research project that personally identifies you will not be voluntarily released or disclosed without your separate consent, except as specifically required by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a participant. Research records will be stored securely and only researchers will have access to the records. If you grant permission for you to be audiotaped, audiotapes will also be stored securely for a minimum of three years on servers for a minimum of three years and then destroyed. Audiotapes will not be used for educational purposes.

Voluntary Nature of the Study

Participation in this study is voluntary:

Your decision whether or not to participate will not affect your current or future relations with Lehigh University or your high school. You are free to not answer any question or withdraw at any time without affecting these relationships. If you decide to stop participation in the study, there will be no penalty and you will not lose any benefits to which you are otherwise entitled.

Contacts and Questions

The researcher conducting this study is:

Daria Kuscenko. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact through Daria Kuscenko, Lehigh University, dak410@Lehigh.EDU or 908-204-2585. You may also contact Dr. Brook Sawyer at brooksawyer@lehigh.edu or 610-758-3236.

Questions or Concerns:

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact Naomi Coll at (610)758-2985 (email: nac314@lehigh.edu) of Lehigh University's Office of Research and Sponsored Programs. All reports or correspondence will be kept confidential.

Statement of Consent

I have read the above information. I have had the opportunity to ask questions and have my questions answered.

Please check one of the three boxes below in regard to whether you assent to participate in the research study and whether or not you may be audiotaped. Please complete all of the requested information.

☐	YES, I voluntarily agree to participate in this project <u>and</u> to be audiotaped.

_____
Printed name of subject

YES, I voluntarily agree to participate in this project, but <u>not</u> to be audiotaped.

_____
Printed name of subject (child)

☐

NO, I do not agree to participate in this project.

☐

_____
Printed name of subject

Appendix F: DocuViz Visualization

As a plug-in application, DocuViz provides a visualization of the timeline, volume, and position of individual writers' contributions to a Google Doc. In DocuViz, individual writers' contributions are represented by different colors. A user can view the flow of the entire revision history of a document at once, or change the revision date and time range to gain a closer look at separate work sessions.

As a tool providing an alternative view of a document, DocuViz exposes more patterns in collaboration, such as a simpler cooperative approach below in which separate contributions by users remain generally intact:
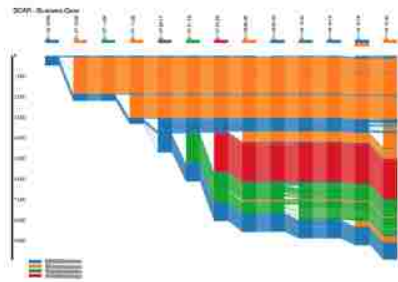

Figure 2. DocuViz cooperation.

Alternatively, collaborative approaches with overlapping user interaction also appear:
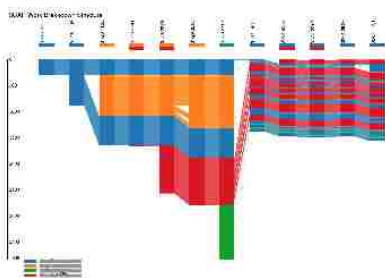

Figure 3. DocuViz collaboration.

The interactive features of DocuViz may also be examined through a demonstration via the following link: youtube.com/watch?v=TwXm9oS4CgY

Appendix G: Identification of Revised Text

In order to identify excerpts of documents that underwent revision, both the Google

Document revision history and DocuViz visualization of documents were reviewed and cross-

examined.

Figures 4 and 5 below present paired views of the same excerpt from the same document,

one view accessible through the revision history, and another view through the DocuViz

visualization.

In the DocuViz view of an excerpt (Figure 4) below, the application color codes the

original drafter's contributions in green, the first insertion by a second writer in orange, and the

second insertion by a third writer in blue.

Figure 4. DocuViz visualization excerpt, group 4 CW task 2.

This DocuViz view suggests that a revision occurred due to the interwoven nature of

multiple writer's contributions. It is possible to view the text that corresponds with the color-

coded contributions in a pop-up window in DocuViz as a method to identify the revised text and

its context.

In the figure below (Figure 5) from the Google Doc Revision History of a document, the

same portion of original text that was green in the DocuViz appears in orange. The purple text

was contributed by the second writer, and the green text was contributed by the third writer.

2. Create a plot diagram/rollercoaster and describe each point. Create two questions at the end. This plot diagram should be primarily based off of the other short stories assigned
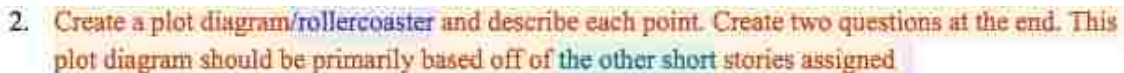
Figure 5. Revision history excerpt, group 4 CW task 2.

The Google Doc revision history view provides the entire document and color-coded

changes in context with all contributions visible simultaneously.

By pairing both versions of the same document excerpt, the isolated, yet integrated, addition of an alternate word choice and additional idea included in one group member's original draft clarifies the revision targets selected by writing partners. Therefore, the Google Doc revision history provides a clearer view of what type of revision occurred that the DocuViz suggested to investigate further. For the purpose of identifying excerpts of revised texts, therefore, DocuViz visualizations identified which segments of text to investigate, and the Google Doc revision history was used to verify both the existence and nature of the revision.

Appendix H: Demographic Survey

This demographic survey was used to establish group norms between the two groups, treatment and control.

1. Student ID: _____

2. Please indicate your gender:
____ Female   ____ Male

3. Please indicate your race/ethnicity:

____ White
____ Latino
____ African-American
____ Native American
____ Asian/Pacific Islander
____ Other

3. Please indicate your age: _____ 15   _____ 16   _____ other

4. Please indicate how often you write on your own:

_____Less than 1 X month
_____Once a month
_____Several times a month
_____Once a week
_____More than once a week

5. Please indicate how often you write with one other person:

_____Less than 1 X month
_____Once a month
_____Several times a month
_____Once a week
_____More than once a week

5. Please indicate how often you write with more than one other person:

_____Less than 1 X month
_____Once a month
_____Several times a month
_____Once a week
_____More than once a week

Appendix I: Exit Survey

All treatment condition participants completed an exit survey, separate from the final metacognitive measurement. The exit survey asked participants two open-ended questions about the benefits, difficulties, and concerns experienced during collaborative writing. One Likert scale response question was asked about their continued and future use of the revision decision method.

1. What do you think are some of the benefits of using a revision decision method to write collaboratively?

2. What do you think are some of the difficulties of using a revision decision method to write collaboratively?

3. How likely are you to continue using the revision decision method to write collaboratively?

_____ very unlikely (1)
_____ unlikely (2)
_____ somewhat unlikely (3)
_____ somewhat likely (4)
_____ likely (5)
_____ very likely (6)

Appendix J: Focus Group Interview

The primary research question the focus group interviews targeted regarded the effect of a revision decision method on feelings of ownership.

Focus groups were asked to respond to the following questions:

1. What, if anything, did you find helpful about this way of writing collaboratively?

2. What, if anything, did you find difficult about this way of writing collaboratively?

3. Sometimes it is hard to write together because we get very protective of our writing. We don't like to hear that we need to change something. This happens to me a lot.

4. Is this something that you feel when writing collaboratively?

5. Is this something that you think about other people feelings when writing collaboratively?

6. Did this experience using this method change how you felt about "owning" your writing?

    a. If so, how?

    b. If not, why do you think it didn't?

7. Did this experience using this method change how you felt about other people "owning" their writing?

    a. If so, how?

    b. If not, why do you think it didn't?

Since participants did not express difficulty in remembering or elaborating upon their experiences, their collaborative documents and the DocuViz visualizations of their collaborative documents were not used as a learning artifact to support elaboration.

Appendix K: Metacognition Survey

The survey was developed by Garrison & Akyol (2015). Study participants completed

the survey using Google Forms through the study's Google Classroom.

The survey applies a Likert scale for responses, ranging from 1 (*very untrue of me)* to *6*

(very true of me).

When I am engaged in the learning process as an INDIVIDUAL:

	Very untrue of me	Untrue of me	Somewhat untrue of me	Somewhat true of me	True of me	Very true of me
I am aware of my effort.						
I am aware of my thinking.						
I know my level of motivation.						
I question my thoughts.						
I make judgments about the difficulty of a problem.						
I am aware of my existing knowledge.						
I am aware of my level of learning.						
I assess my understanding.						
I change my strategy when I need to.						
I search for new strategies when needed.						
I apply strategies.						
I assess how I approach the problem.						
I assess my strategies.						
I pay attention to the						

ideas of others.						
I listen to the comments of others.						
I consider the feedback of others.						
I reject feedback at times because writing is personal.*						
I reflect upon the comments of others.						
I observe how others are doing.						
I look for confirmation of my understanding from others.						
I request information from others.						
I respond to the contributions that others make.						
I challenge the strategies of others.						
I challenge the perspective of others.						
I help the learning of others.						
I hesitate when giving feedback to others because writing is personal.*						
I observe the strategies of others.						
I monitor the learning of others.						

*Note that these two items were added to the survey instrument in order to investigate the third research question regarding the effect of a revision decision method upon feelings of ownership. They were not part of the original instrument, and they were not included in the calculation of metacognition scores. They were embedded in this instrument for convenience purposes in order to minimize the disruption of survey completion in the classroom setting.

.Appendix L: Collaborative Writing Disposition Check

This collaborative writing disposition check was a paper and pencil task. It was used as a

pretest before the baseline collaborative task, as well as a posttest after the final collaborative

writing task.

The survey applies a Likert scale for responses, ranging from 1 (*very untrue of me*) to 6

(*very true of me*).

I am comfortable revising someone else's writing when writing collaboratively.
____ very untrue of me (1)
____ untrue of me (2)
____ somewhat untrue of me (3)
____ somewhat true of me (4)
____ true of me (5)
____ very true of me (6)

I am comfortable with someone else revising my writing when writing collaboratively.

____ very untrue of me (1)
____ untrue of me (2)
____ somewhat untrue of me (3)
____ somewhat true of me (4)
____ true of me (5)
____ very true of me (6)

Appendix M: A Priori Codes

The first set of a priori codes was used to investigate the depth of revision objectives.

The codes were drawn from Education Northwest's 6+1 Trait Writing Model, yet they are

presented in a hierarchical order with three levels to reflect the potential of collaborative writers

to consider multiple options with collateral effects within each trait.

Trait	Description	Codes
SHALLOW OBJECTIVES		
Conventions	includes aspects of mechanical correctness, such as spelling, punctuation, capitalization, grammar, usage, paragraphing	Conv1: no alternatives provided; only one replacement provided Conv2: two alternatives provided Conv2+: 2 or more alternatives provided
Organization	structure reliant upon relationships such as compare-contrast, cause-effect, or problem-solution; also paragraph structure, logical progression, and closure (*can be considered a meaningful target when considering options*)	Org1 Org2 Org2+ OrgM2 OrgM2+
Presentation	layout of text and document features	Pres1 Pres2 Pres2+
MEANINGFUL OBJECTIVES		
Ideas	content that comprises the main message of the document, dependent upon "interesting, important, and informative" choices of detail; meaningful target	Id1 Id2 Id2+
Word choice	includes figurative devices (metaphors, similes, analogies) in addition to active vocabulary that considers both denotation and connotation of words, as well as whether or not language "moves" the reader; meaningful target	WC1 WC2 WC2+
Sentence fluency	length, type, beginnings, and structures that vary sentence structures to create rhythm and flow; meaningful target	SF1 SF2 SF2+

DEEPER OBJECTIVE		
Voice	stylistic decisions that create a "personal tone and flavor" accompanying the document's message; deeper target	V1 V2 V2+

The second set of a prior codes would have been used to investigate depth of writing process objectives if the instruments measuring writing process objective revision had captured data for analysis of this aspect of the research questions.

SHALLOW OBJECTIVES		
Conventions	indicates attention paid to what writers are supposed to do according to directions or instructional materials, as well as minor adjustments with limited impact	PConv1: no alternatives to provided directions PConv2+: at least two alternatives within directions considered
DEEPER OBJECTIVES		
Scripting	indicates attention paid to proposing changes or modifications to the revision decision method or other instructional directions/materials with significant impact	PS1: one alternative provided PS2+: more than one alternative provided

The third set of a priori codes was used to investigate the feelings of ownership. This code set drew upon the work of Schoon, Narciss, and Körndle (2015) that found a correlation between the pronouns "I" with self-regulation, "you" with co-regulation, and "we" with shared regulation. This study investigated whether or not these pronouns correlated with the reported feelings of ownership that emerged during the qualitative dataset of the focus group interviews.

Pronoun	Description	Code
I	indicates self-regulation	SReg
You	Indicates co-regulation	CReg
We	indicates shared regulation	ShReg

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