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THE IMPACT OF DIGITAL AND PAPER-BASED GRAPHIC ORGANIZERS ON

THE PERSUASIVE WRITING PROCESS OF FOURTH AND FIFTH GRADE

STUDENTS

by

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DISSERTATION APPROVAL PAGE

This is to certify that the dissertation prepared by <u>Mila Thomas Fuller</u>, entitled <u>Impact of Digital</u> <u>and Paper-based Graphic Organizers on the Persuasive Writing Process for Fourth and Fifth</u> <u>Grade Students</u>, has been approved by this committee as satisfactory completion of the requirement for the degree of Doctor of Education in Instructional Technology, in the Department of Educational Technology and Literacy.

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DEDICATION

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ABSTRACT

At present, graphic organizers have become recognized instructional tools to help support students as they write. The purpose of this study is to examine the impact of paper-based and digital graphic organizers to improve persuasive writing of fourth and fifth grade students. A quasi-experimental study with a comparison design with pre-test and post-tests was used with the switching replication method. The population consists of sixty-seven public and private school students in fourth and fifth grade. The most prominent results indicate that the use of a digital graphic organizer first, leads to significant improvements in the following five writing outcome areas: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores. Likewise, female students also showed significant improvements in all five writing outcomes. Comparable to digital, the use of paper-based graphic organizers first, resulted in significant improvements in three areas: supporting arguments, conclusion statements, and overall scores. For older students (aged 10-11), the use of both paper-based and digital graphic organizers first, leads to significant improvements in the following five writing outcome areas: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores. The overall results indicate that graphic organizers yield significant improvements in the persuasive writing of fourth and fifth grade students. Furthermore, a consistent finding throughout this study is that the use of paper-based and digital graphic organizers results in significant improvements in these three areas: supporting arguments, conclusion statements, and overall scores.

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CHAPTER 1

Introduction

The primary purpose of the current study was to examine and further research the impact of digital graphic organizers, as compared to paper-based organizers, as a tool to improve persuasive writing of fourth and fifth grade students. The research explored student perceptions toward writing when using digital graphic organizers and paper-based organizers. In addition, the research investigated differences in the quality of persuasive writing essays when using digital graphic organizers as compared to paper-based organizers. This chapter describes the statement of the problem, the rationale, and definitions used in the current study.

Statement of the Problem

The National Center for Education Statistics (2012) reported 24,100 students at grade 8 and 28,100 students at grade 12 were administered the National Assessment of Educational Progress (NAEP) for writing. During the assessment, students responded to various writing tasks that included writing to persuade. NAEP defines *persuasive writing* as a form that seeks to influence the reader to take action and/or bring about change. The National Center for Educational Statistics (2012) reported that 24% of students in eighth and twelfth grade scored proficient. According to the National Writing Project (2012), "learning to write well is one of the most challenging tasks for anyone, regardless of age" (Encourage Writing section, para. 1). There is a current research base on the use of graphic

organizers to improve the comprehension skills of students with learning

disabilities, the impact of partial vs. blank graphic organizers, the use of graphic

organizers as a note-taking tool, and the impact of digital graphic organizers

used individually as compared to those used as a collaboration tool

(Anderson-Inman, Ditson, & Ditson, 1998; Blankenship, Ayres, & Langone, 2005;

Crooks, White, & Barnard, 2007; DiCecco & Gleason, 2002; Ives, 2007, Hudson,

Lignugaris-Kraft, & Miller, 1993; Kiewra, DuBois, Christian, & McShane, 1988;

Robinson, Katayama, Beth, Odom, Hsieh, & Vanderveen, 2006). Several

researchers have indicated that there is a need for further research on the impact

of the use of digital organizers as a learning tool to enhance student writing

(Burgess, 2008; Franciscone, 2008; Lorber, 2004; Unzueta, 2009).

Rationale

The National Writing Project (2012) states that writing is essential to

communication, learning, and citizenship and it helps us convey ideas, solve

problems, and understand our changing world. The National Assessment of

Educational Progress (2012) indicates that writing tasks have the potential to

appear daunting to students, and teachers look for ways to motivate students to

understand the writing process. A joint position statement of the International

Reading Association and the National Association for the Education of Young

Children (1998) states that learning to read and write is a complex, multifaceted

process that requires a wide variety of instructional approaches. The National

Assessment of Educational Progress (NAEP) required in 2011 that both eighth

and twelfth graders create writing components using an online assessment and will require fourth graders to do so by 2019 (Olson, 2007).

According to the National Council of Teachers of English (2012), "writing instruction must accommodate the explosion in technology from the world around us. From the use of basic word processing to support drafting, revision, and editing, to the use of hypertext and the infusion of visual components in writing" (Composing Occurs in Different Modalities and Technologies section, para. 2). To support this claim the National Council of Teachers of English (2012) hosts the National Day on Writing. This special day encourages the public to read and publish writing developed and shared in a variety of ways, from contributions created on word processors, graphics, electronic presentations, videos, and more. Goldberg, Russell, and Cook (2003) reported that digital technology enhances writing by assisting students to develop compositions of greater length and higher quality, and that students are more engaged and motivated as compared to their peers who are not using digital technologies.

The National Governors Association Center for Best Practices and the Council of Chief State School Officers (2010) define the Common Core State Standards as knowledge and skills students should have within their K-12 education careers so that they will graduate high school able to succeed in entry-level, credit-bearing academic college courses and in workforce training programs. The common core standards for writing state that the ability to write logical arguments based on substantive claims, sound reasoning, and relevant evidence is a cornerstone of the new writing standards. Specific common core

standards indicate that in grades K-2 students should explore a variety of digital tools to produce and publish writing. For grades 3-5, students should use technology to produce and publish writing, as well as to interact and collaborate with others.

Graphic organizers, specifically digital graphic organizers, aid students with the planning and organization of final writing products (Lorber, 2004, Unzueta, 2009). Digital graphic organizers have features that allow students to organize, edit, and customize their graphic organizers using various font styles, graphics, hyperlinks, and audio. In the digital form, graphic organizers assist students with writing assignments by allowing them to easily update and revise content while working toward a final writing assignment (Harrington, Holik, & Hurt, 1988). Likewise, Royer and Royer (2004) reported that students were also able to make revisions to their written text and communicate more clearly as they uncovered relationships between concepts. This can be attributed to the use of various electronic tools within digital graphic organizers that allow for ease of revision. Unlike paper-based organizers, digital organizers provide an opportunity to reorganize text while utilizing easy-to-access editing tools. According to Anderson-Inman et al. (1998), there is an ease of construction, an ease of revision, and the ability to customize concept maps in ways that are not possible when using paper and pencil.

Significance

There is a current gap (Burgess, 2008; Franciscone, 2008; Unzueta, 2009) in the literature on the impact of digital graphic organizers and writing. This current study will provide evidence and recommendations on the impact of digital graphic organizers and paper-based graphic organizers on the persuasive writing process of fourth and fifth grade students.

Definition of Terms

The following terms are used throughout the current study:

Cognitive Mapping. A planning strategy also known as concept mapping, flowcharting, semantic mapping, semantic webbing, and using graphic organizers. This approach is used to categorize information by creating visual representations of text and personal knowledge (Sturm & Rankin-Erickson, 2002).

Content Items. This term will be used when referencing the following writing outcomes used in the current study: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores.

DARE. A four-step essay-writing process using a mnemonic that encourages students to 1) develop a topic sentence, 2) add supporting ideas, 3) reject at least one argument for the other side and support their opinion, and 4) end with a conclusion (De La Paz & Graham, 1997). Susan De La Paz and Steve Graham developed this strategy.

Digital First & Recent Paper Use/PDU (DF & RPU/PDU). When referencing these groups in context of post-test 1 to post-test 2, the aforementioned terms will be used to indicate the type of graphic organizer used for the first writing assignment (post-test 1), and then the type of graphic organizer used for the second writing assignment (post-test 2). PDU means Prior Digital Use.

Digital First/PS (DF/PS). The digital first/ps group refers to students that utilized a digital graphic organizer for the first writing assignment they completed at post-test 1. The term first, signifies the type of graphic organizer that was administered at post-test 1. PS means Paper Second

Digital Graphic Organizer. An organizer, in a digital format, that allows users to organize ideas, information, and resources using text boxes, outlines, graphics, audio, and videos.

Lesson Plan. A plan that provides key information on how to carry out a lesson. A lesson plan includes student objectives, performance indicators, resources, and assessment measures.

Paper-Based Organizer. An organizer, in paper form, that allows users to organize ideas and information in a written format.

Paper First & Recent Digital Use/PPU (PF & RDU/RDU). When referencing these groups in context of post-test 1 to post-test 2, the aforementioned terms will be used to indicate the type of graphic organizer used for the first writing assignment (post-test 1), and then the type of graphic

organizer used for the second writing assignment (post-test 2). PPU means Prior Paper Use.

Paper First/DS (PF/DS). Those students labeled paper first/ds utilized a paper-based graphic organizer for the first writing assignment, which was administered at post-test 1. DS means Digital Second

Persuasive Writing Essay. A form of writing that includes arguments and counterarguments with the intent to convince the reader or target audience on a given topic.

Process Mechanic Items. This term will be used when referencing the following writing outcomes used in the current study: organization, tone, spelling, and grammar.

Quality of Persuasive Writing. In the current study, the quality of persuasive writing will be scored based on assessment of the goal statements, reasoning statements, supporting arguments, conclusion statements, organization, tone, spelling, grammar, and the overall summary of scores.

Recent Digital Use/Prior Paper Use (RDU/PPU). When referencing these groups in context of pre-test to post-test 2 RDU/PPU indicates that at post-test 2 a digital graphic organizer was recently used and previously, at post-test 1, a paper-based graphic organizer was used.

Recent Paper Use/Prior Digital Use (RPU/PDU). When referencing these groups in context of pre-test to post-test 2 RPU/PDU indicates that at post-test 2 a paper-based graphic organizer was recently used and previously, at post-test 1, a digital graphic organizer was used.

Rubric. A scoring tool or scoring procedure document that provides detailed information on how student work will be evaluated.

STOP. A four-step planning process using a mnemonic that asks students to suspend judgment, take a side, organize ideas, and plan more while they write (De La Paz & Graham, 1997). Susan De La Paz and Steve Graham developed this strategy.

T-Unit. One main writing clause (student idea) and all the subordinate clauses attached to or embedded within it (Hunt et al., 1968).

CHAPTER 2

LITERATURE REVIEW

This review of literature addressed how researchers have defined graphic organizers, different ways that graphic organizers are used to enhance student learning, and current research on the impact of graphic organizers on students with learning disabilities. In addition, this literature review also focused on the use of graphic organizers to improve comprehension skills, research findings about proven strategies to teach persuasive writing, and a theoretical framework related to the existing study of graphic organizers as a tool for teaching and learning.

Defining Graphic Organizers

In reviewing the literature, it was evident that the concepts of graphic organizers are referred to in different ways due to slight variations in style and approach. Jonassen, Beissner, and Yacci (1993) explained that concept maps are representations of concepts and the interrelationships, between these concepts, are intended to represent the knowledge structures that humans store in their minds. Graphic organizers are visual portrayals or illustrations that depict relationships among the key concepts taken from the learning task (Hudson, Lignugaris-Kraft, & Miller, 1993; Moore & Readence, 1984). Blankenship et al. (2005) also refer to cognitive-mapping software as a tool that helps learners organize their work. Other references to graphic organizers include concept

mapping, mind mapping, graphical representations, semantic organizers/maps, and cognitive maps.

Upon reviewing the varied references to graphic organizers, many researchers indicate that they are used to help organize ideas using a non-linear method, which does not require a specific sequence, for teaching and learning (Ausubel, 1960; Anderson-Inman, Ditson, & Ditson, 1998; Blankenship et al., 2005; Bruillard & Baron, 2000; Chiou, 2008; DiCecco & Gleason, 2002; Gerstner & Bogner, 2010; Hay, Kinchin, & Lygo-Baker, 2008; Kwon & Cifuentes, 2007; Meyer, 1995; Royer & Royer, 2004; Sturm & Rankin-Erickson, 2002). For the purpose of this literature review, we utilized the term graphic organizer unless it was referenced within a specific article by another name.

Educational Uses of Graphic Organizers

Impact of Graphic Organizers. Graphic organizers have been used as a tool to assist learners with skills such as reading and text comprehension, teaching, and note- taking (Anderson-Inman, Ditson, & Ditson, 1998; Blankenship et al., 2005; Crooks, White, & Barnard, 2007; DiCecco & Gleason, 2002; Hudson, Lignugaris-Kraft, & Miller, 1993; Ives, 2007; Nussbaum & Schraw, 2007; Robinson, Katayama, et al., 2006). Graphic organizers have also been utilized as a component of an instructional strategy to support students as they develop new ideas that contribute to written essays (Lorber, 2004; Unzueta, 2009). Several studies focusing on teaching strategies that address how to best teach students the art of writing persuasively and/or that focus on argumentation skills utilize graphic organizers as a primary or secondary intervention tool to

support student learners (Davies, 2008; De La Paz & Graham, 1997; Graham & Harris, 2003; Jacobson & Reid, 2010; Mason, Benedek-Wood, & Valasa, 2009; Nussbaum & Schraw, 2007; Santangelo & Olinghouse, 2009).

Ausubel (1960), one of the early pioneers in graphic organizer research, explored the impact of graphic organizers on retaining new verbal information. He concluded his study with two explanations related to the impact of graphic organizers. Ausubel explained that learners use organizers to recall information they are already familiar with and then they connect those existing ideas to new information gained. He also explained that graphic organizers, when used appropriately, allow learners to adequately anchor new information. Bruillard and Baron (2000) stated that within the realm of education, graphic organizers assist with establishing relationships between concepts and are tools used for both research and communication.

Kwon and Cifuentes (2007) stated that concept mapping, another common name for graphic organizers, serves as a visualization tool and learning strategy that facilitates thought. In many research-based studies, researchers explored ways to use graphic organizers for organizing ideas that led to research skills and better reading comprehension for students who were on skill level and those struggling with learning disabilities or low comprehension skills (Anderson-Inman, Ditson, & Ditson, 1998; Blankenship et al., 2005; Burgess, 2008; Crooks, White, & Barnard, 2007; DiCecco & Gleason, 2002; Franciscone, 2008; Hudson, Lignugaris-Kraft, & Miller, 1993; Ives, 2007; Lorber, 2004).

Teachers have often used graphic organizers as a way to help students brainstorm new ideas as they prepare to submit writing assignments. Some studies suggested that students became disruptive as a result of low comprehension skills and that graphic organizers afforded these students the ability to focus and perform using a learning strategy that complemented individual learning styles (Drapeau, 1998; Harrington, Holik, & Hurt, 1988).

Graphic Organizers and Students with Learning Disabilities. Several studies have been conducted on the impact of graphic organizers when used with students with learning disabilities (Anderson-Inman, Ditson, & Ditson, 1998; Blankenship et al., 2005; DiCecco & Gleason, 2002; Hudson, Lignugaris-Kraft, & Miller, 1993; Ives, 2007). These studies have primarily focused on improving the overall comprehension of mathematics and reading comprehension skills of students with diagnosed learning disabilities (Blankenship et al., 2005; Ives, 2007). Ives (2007) indicated that graphic organizers have been shown to improve reading comprehension of students with learning disabilities, but they can also be applied to upper level secondary mathematics content as well. A study by Ives (2007) consisted of two experimental groups of secondary and high school students with varied learning disorders. In the first study, only one group used a graphic organizer. In the second experimental study, the use of a graphic organizer was the same, but the population and subject-area (Mathematics) was different. The test used for both studies was investigator-generated and disclosed that the experimental group, using graphic organizers, outperformed those without graphic organizers.

In another study focused on students with learning disabilities, graphic organizers were used as a tool to attain relational knowledge from expository texts. DiCecco and Gleason (2002) explained that graphic organizers help identify important details in passages while eliminating extraneous information that can distract poor readers and students with learning disabilities from the content. In the DiCecco and Gleason (2002) study, a pre-test/post-test control group was used, along with a multiple-choice questionnaire, a fact quiz, and a writing sample. In the experiment, there was an increase in relational knowledge. The experimental group, using graphic organizers, had significantly more relational knowledge statements than students without graphic organizers when the writing post-test was administered (DiCecco & Gleason, 2002). However, it appeared that the type of responses on fact quizzes and multiple-choice questions resulted in no change when graphic organizers were used. The DiCecco and Gleason (2002) study helped inform this researcher's decision to use a pre- and post-test control group in the current study.

Graphic Organizers for Note-Taking and Comprehension Skills. While graphic organizers have been used as a tool to help learners organize ideas, Crooks, White, & Barnard (2007) explored the impact of graphic organizers to serve as an assistive tool for note-taking leading to increased comprehension. These two studies explored the use of note-taking on both partial and fully completed graphic organizers (Crooks, White, & Barnard, 2007; Robinson, Katayama, et al., 2006). The studies reported that the use of graphic organizers made a significant difference. Crooks, White, and Barnard (2007)

explained that partially completed graphic organizers led users to stay focused while conducting research to complete the organizers, which led to users taking control of their learning by focusing on the task at hand.

Some studies explored the use of both spatially large and small graphic organizers (Kiewra, DuBois, Christian, & McShane, 1988; Robinson & Kiewra, 1995). Large graphic organizers were defined as those that provided ample writing space for participants, while small graphic organizers lacked adequate space. While both large and small organizers had characteristics of assisting users with comprehension skills, through these studies it became clear that the larger organizers had a greater impact on comprehension skills. Due to the spatial format of graphic organizers, several researchers have drawn the conclusion that graphic organizers are more advantageous as a tool for note-taking and increasing comprehension (e.g., Kiewra, DuBois, Christian, & McShane, 1988; Robinson & Kiewra, 1995).

As students develop persuasive writing essays, the utilization of a graphic organizer assists them as they read supporting materials, take critical notes to strengthen their writing, and plan their supporting details for the final writing composition. Crooks, White, and Barnard (2007) conducted a study to gain a better understanding of factors related to the effectiveness of note-taking while using small and large digital graphic organizers. In their study, 36 university students from a large university in the United States were assigned to one of four experimental conditions. A post-test was issued to measure knowledge transfer, including the amount and quality of notes taken by the students. The researchers

asserted that large graphic organizers had better results when used for summary notes, while the small graphic organizer resulted in better results when used for verbatim notes (Crooks, White, & Barnard, 2007). The Crooks, White, and Barnard (2007) study has limited applicability to the current study because of the difference in the age of participants and concentrated focus on the spatial size of organizers. However, the Crooks, White, and Barnard (2007) study is still important because the digital graphic organizer software used in the current study will allow students an opportunity to adjust the size of the organizer boxes, as needed, based on the amount of text they want to include to communicate a visual representation of their work.

In a study conducted by Robinson, Katayama, Beth, Odom, Hsieh, and Vanderveen (2006) three experiments were administered to university students focusing on the impact of graphic organizer use on note-taking and comprehension. In the first experiment, a comparison was conducted of students using partial graphic organizers while another group of students used completed graphic organizers in two different semesters. The study reported that students using partial organizers scored higher than those using the completed graphic organizers. In the second experiment, students utilized a digital graphic organizer to complete a graphic organizer cell (t-unit) by choosing from three different multiple-choice options that appeared when they clicked the organizer cell. This study revealed that students using partial digital graphic organizers scored higher than those with complete graphic organizers. In the third experiment, groups of students worked on timed digital graphic organizers online. One group received

partial organizers and the other group received complete graphic organizers. Consistent with the findings from the first two experiments, students using partial organizers scored higher (Robinson, Katayama, et al., 2006). Robinson, Katayama, et al., (2006) has limited applicability to the current study because of the difference in the age of participants. However, the study is still important as students use graphic organizers to plan, organize, and transfer knowledge.

When assessing comprehension levels of students with learning disabilities, it has become apparent that students struggle with comprehension due to poor reading skills (Blankenship et al., 2005). Once students with low reading levels find a way to connect and understand text through the use of graphic organizers, it raises their levels of confidence (Blankenship et al., 2005). When thinking about how graphic organizers serve students as a note-taking tool, Blankenship et al. (2005) explained that it gives students with emotional disorders the autonomy to work independently and take notes on text that would have otherwise been difficult to understand. There is a potential to reach students with emotional disorders, as schools in the study include emotional disturbances as a part of the learning disability category.

Digital Graphic Organizers. In a study conducted by Blankenship et al. (2005) that explored the use of digital graphic organizers, the researcher evaluated the pairing of cognitive mapping and computer software on the reading comprehension of students with emotional behavior disorders. Blankenship et al. (2005) indicated that students with emotional disorders who use digital graphic organizers showed improvement in retention of information. In the current study,

students will use graphic organizers to retain information as they transfer knowledge from the graphic organizer to the final persuasive writing essay. The Blankenship et al. (2005) study reported that digital organizers can serve as a support tool for students with emotional disorders, and the use of digital graphic organizers can lead to students with emotional disorders working independently while grasping content knowledge. Blankenship et al. (2005) stated that the use of technology allowed greater autonomy for students with emotional disorders. This autonomy allowed students to become independent learners and gave them a tool that helped them find success in reading comprehension.

Digital graphic organizers can assist students with writing assignments by allowing them varied ways to update and revise content as they work toward a final writing assignment. Harrington, Holik, and Hurt (1988) reported that students can customize graphic organizers through the use of technology by using both the thesaurus and spell check functions to enhance vocabulary development and correct misspelled words. Enhancing text, through graphic organizer use, allows students to stay focused on the communicative purpose of writing (Harrington, Holik, & Hurt, 1988).

Sturm and Rankin-Erickson (2002) conducted a nine-week repeated measures within-subject design study to compare hand-drawn and computer-generated concept mapping on the descriptive writing process of 12 eighth grade students. The study conditions included the utilization of a hand-drawn map, computer-generated map, and no concept map. The study focused on the following four elements of essay writing: number of words,

syntactic maturity, number of T-units, and holistic writing scores. Students who used the maps made improvements while using both types of maps as a prewriting strategy. However, it appeared that students in all three conditions (no-mapping, hand mapping, and computer mapping) appeared to write longer and better essays than they did prior to receiving mapping instruction (Sturm & Rankin-Erickson, 2002). This finding revealed that writing improvements were made across all conditions after participants had been previously exposed to mapping instruction. However, there was no significant difference in using one condition over another as all three conditions showed improvements.

Lin, Strickland, Ray, and Denner (2004) conducted a 2 by 2 (teacher) by 7 (class) nested factorial design that examined pencil concept mapping as a prewriting strategy for middle school students' persuasive writing. The Lin, Strickland, Ray, and Denner (2004) study population consisted of 278 eighth grade students and researchers asserted that when using a computer-based map, more ideas were generated as compared to paper. When using the computer, the quality of the students' thesis statements improved, as compared to paper (Lin, Strickland, Ray, & Denner, 2004). This included improvements in both the quantity and quality of the reasoning statements, examples, and attention getting statements (Lin, Strickland, Ray, & Denner, 2004). However, their study also reported higher persuasive writing scores when students used paper-and-pencil as compared to computer-based concept mapping. The researchers speculate that this increase in persuasive writing scores may have

been the result of students spending more time to produce computer generated concept maps and students being distracted by the use of the tool.

Lorenz, Green, and Brown (2009) completed a three-week study on the use of digital graphic organizers on prewriting activities. In their study, 24 second grade students created personal narratives which they completed using a paper-based organizer and then a computer-generated organizer. The second grade students who created computer-generated maps scored higher, wrote more, and felt better about their writing than the students who created hand-drawn maps, or who used no specific tools. Students indicated they preferred the computer-generated maps because the hand-drawn maps were often too sloppy, too hard to modify, and too confusing in their lack of organization (Lorenz, Green, and Brown, 2009). The results indicated that while graphic organizers showed minimal impact on quantity of writing, there was definitely an increase in students' motivation levels and the length of time they spent on the assignment when using the computer-generated graphic organizer.

Lorenz, Green, and Brown (2009) indicated that the findings were likely a result of one of the major study limitations in that research was conducted in a single school with a small sample size of 24 students. Lorenz, Green, and Brown (2009) acknowledged that while minimal impact was made, using computing tools to teach prewriting does not cause any harm and students interact differently based on skill and reading levels. According to Lorenz, Green, and Brown (2009), students demonstrated verbal enthusiasm toward using the computer graphic organizer as compared to the traditional paper and pencil

methods.

In two doctoral dissertations, Unzueta (2009) researched the use of computer graphic organizers for persuasive composition writing, and Lorber (2004) researched instructional computer technology and student learning: an investigation in using Graphic Organizers Inspiration Software to improve eighth grade students' ability to write.

Unzueta (2009) explored the use of a computer graphic organizer for persuasive composition writing by Hispanic students with specific learning disabilities. Unzueta (2009) used a multiple baseline design across subjects that lasted during the final trimester of school. The Unzueta (2009) study examined the effects of the graphic organizer on the following aspects: number of arguments and supporting details, number and percentage of transferred arguments and supporting details, planning time, writing fluency, syntactical maturity (the shortest grammatical sentence without fragments), and overall organization. In the Unzueta (2009) study students planned and then wrote a persuasive essay using only paper and pencil. Later, students were asked to plan persuasive essays with the use of computer graphic organizers. The Unzueta (2009) study reported that the use of computer graphic organizers had a positive impact on planning and composing persuasive writing essays. In analyzing the variables, Unzueta reported that there was an increase in the number of supporting details planned, percentage of supporting details transferred, planning time, writing fluency, syntactical maturity in number of T-units, and overall organization of the composition. Unzueta also reported that

there were minor increases in the mean number of arguments planned and written, varying effects in the percent of transferred arguments, and a decrease in the T-unit mean length. Teacher nomination was used as a selection method for the identification of participants in the Unzeuta (2009) study, and participants included two female and two male Hispanic middle school students (Unzueta, 2009).

Unzueta identified timing as a limitation in that they had to plan around spring break, causing a gap of time. The end-of-year events also limited the overall number of days of the research. As the Unzueta (2009) study conflicted with final exams, it had to come to an end.

The Lorber (2004) study consisted of two five-week studies that explored whether or not the use of a digital graphic organizer improved eighth-grade students' ability to write expository pieces. Lorber (2004) used a two-trial, pre-test/post-test design. Both quantitative and qualitative data were collected that was composed of writing scores from the students, survey responses from randomly selected students, and data from meetings with English teachers. The data collected was analyzed using a multivariate analysis of covariance. An analysis of covariance was used to compare intervention and nonintervention numerical scores from the pre and post surveys and writing essay scores.

Upon completion of the Lorber (2004) study, it was revealed that students who utilized the digital graphic organizer showed an increase in their ability to organize their ideas and on their final assigned grade. Lorber (2004) explained that students indicated that they were restricted when using a traditional outline

as compared to a graphic organizer. However, there were no significant differences in their ability to develop their essay ideas or in their ability to use supporting details in their essays. When comparing low-achieving students to high-achieving students, there were no significant differences on the four student writing variables (topic development, organization of ideas, support, and final grade). In terms of students' perceptions, survey data indicated that there were significant differences in how students in the intervention group, as compared to the non-intervention group, rated themselves on idea generation and stages of idea development.

Overall, Lorber (2004) reported that students wrote better, as indicated by, their final writing scores and organization of ideas when comparing the intervention group to the non-intervention group. However, when examining results of low achieving students to high achieving students digital graphic organizers did not yield any significant differences in student writing.

Lorber identified the following as limitations: limited number of participants, setting, teachers, limited time, and restrictions in the research setting and design. Lorber indicated that time was a limitation chiefly because her study spanned only five weeks. This current study is longer and takes place over the course of a twelve-week span. In the Lorber study, additional limitations included outcomes in that the teachers assessed their students and essay scoring focused only on idea generation and organization. The current study has independent evaluators grading papers to eliminate teacher-student bias, and it seeks to assess more writing components (as indicated in chapter 4).

Motivating Students through Graphic Organizers. When it comes to students staying focused on their writing assignments, it appears that graphic organizers can help capture their attention. Drapeau (1998) indicated that graphic organizers provide structure for students with limited attention spans. In a different study, Harrington, Holik, and Hurt (1998) indicated that graphic organizers also helped students on individualized education plans (IEPs) and English as a Second Language (ESL) students, particularly those who find writing a challenge. In these scenarios, graphic organizers helped students stay focused, organized, and on task. Drapeau (1998) shared that graphic organizers appear to relieve boredom, provide motivation, and assist students as they represent associations between ideas.

In a classroom setting, students often enjoy the opportunity to share their final work as a way to collaborate and spark dialogue with peers. While this may be true, getting to that point may be more challenging. Due to a lack of motivation toward writing, Cook, Green, Meyer, and Saey (2001) explained that students prefer sharing writing contributions rather than composing them. Etchison (1995) explained that it is important to allow students to use graphic organizers to think through their processes. Doing so reduces their fear and increases enthusiasm toward the task. As students increase their level of confidence toward a writing task, they begin viewing themselves as writers.

Cook, Green, Meyer, and Saey's research (2001) also explained that a key element of increasing the motivation to write and what influenced student writing the most was the use of graphic organizers during writing tasks. The

researchers also pointed out that there was an increase in organization skills in writing because of the time dedicated to the use of graphic organizers in the writing curriculum.

Cook, et al., (2001) acknowledged that their study could have benefited from longer intervention times, which would have eliminated students feeling overwhelmed and the inability for students to complete one of the projects due to time. In the current study, the intervention time is scheduled over the course of four 50-minute blocks per lesson, as recommended by the author of the lesson. Cook, et al., (2001) explained that their study was limited due to the uneven number of students needed for pairing. As a result, some students were required to correspond with more than one student rather than only one (Cook, et al., 2001). During the writing sessions, Cook, et al., (2001) indicated that some students provided too much assistance while others did not provide enough when students were paired.

Student Writing and Graphic Organizers. Some researchers support the notion that graphic organizers have the ability to help improve student writing through proper planning and organization techniques (Cook, et al., 2001; Unzeuta, 2009). Meyer (1995) explained that graphic organizers help writers stay on topic by keeping ideas in front of them as they write. Meyer researched the use of paper-based (or handwritten) graphic organizers as a strategy to improve writing. Using a pre- and post-test design with both a control group and experimental group, Meyer's research (1995) concluded that writing was improved using the handwritten organizers.

Meyer (1995) and Bromley, Irwin-DeVitis, and Modlo (1995) indicated that graphic organizers can assist learners with sequence. Meyer connected this to the importance of guiding students through the following four stages of the writing process: prewriting, drafting, revising, and publishing and sharing. After a 13-week study, Meyer's research (1995) explained that students who used graphic organizers showed an improvement in their creative writing assignments.

While the term *organizer* signifies that the tool simply helps to organize writing, Bromley, Irwin-DeVitis, & Modlo (1995) and Moss and Holder (1988) indicate that organizers also represent an effective way to brainstorm and plan writing. Besides using graphic organizers as an organizational tool, Flynn (1995) indicated that graphic organizers assist students who need to visually process information.

In terms of supporting comprehension, the review of literature revealed that graphic organizers assisted with reading comprehension and that became evident in how it supported student writing (Blankenship et al., 2005; Franciscone, 2008; Moss & Holder, 1988; Robinson, Katayama, Beth, Odom, Hsieh, & Vanderveen, 2006).

Moss and Holder (1988) indicated that when graphic organizers were paired with writing prompts it appeared to increase understanding and retention of what students read. They also shared that using graphic organizers appeared to facilitate writing by allowing students to structure information and arrange the important aspects of topics. Bromley, Irwin-DeVitis, and Modlo (1995) pointed

out that, while graphic organizers support revision, they also allow students to see what they may have omitted, by error, from their final writing products.

As it pertains to graphic organizers improving children's writing, Berry, Guzy, Keelan, Kilinski, & Kuknyo's findings (1999) revealed that students showed an improvement in writing skills and were less apprehensive towards the writing process. In another study, Harrington, Holik, and Hurt (1998) shared that students' enjoyment of writing increased and they had an easier time beginning the writing process when they used graphic organizers. In the Harrington, Holik, and Hurt (1998) study, researchers explained that the graphic organizer was the most effective and popular strategy with students. Their study revealed that there was a substantial increase in the number of students who used organizers from the first assignment to the second assignment once introduced to them. Harrington, Holik and Hurt (1998) reported that graphic organizers resulted in students staying focused and submitting more detailed writing assignments.

Writing to Persuade

Teachers have often used graphic organizers as a way to help students develop new ideas and cultivate existing theories as they develop written essays (Unzueta, 2009; DiCecco & Gleason, 2002; Nussbaum & Schraw, 2007). Often, this use of graphic organizers creates an opportunity for students to brainstorm freely and think in a non-linear manner as they work toward organizing their ideas in a linear fashion. An important component of writing persuasively is how students address and support arguments.

It was Davies (2008) who indicated that computer-aided argument mapping (CAAM) was reinventing how critical thinking skills are taught. Davies explained that argument mapping makes the complex simple by allowing students to illustrate their arguments. In an article about making better arguments, Davies suggested that students use a form of a graphical representation (or organizer) to ensure that they address all areas within an argument.

While graphical representation can help assist and support student writers, Graham and Harris (2003) explained that teaching students strategies for planning, drafting, and revising text proves effective in improving the performance of struggling writers. In the current study, this will be addressed by teaching the STOP and DARE writing strategies that can assist those students with documented learning disabilities. Graham and Harris (2006) explained that teaching how to address planning, drafting, and revising text is also helpful for students who are considered more skilled. Overall, this research supports the belief that learning how to plan, how to draft, and how to revise impacts students positively at varied learning abilities.

Writing Strategy: Six-Step Report

Graham, Harris, and MacArthur (2006) utilized the six-step report strategy developed by MacArthur, Schwartz, Graham, Molloy, and Harris (1996) with struggling writers in an effort to help support them as they work to master the writing process. The six steps include (1) choosing a topic, (2) brainstorming all they know and would like to know about the topic, (3) organizing ideas by main points and details on a web, where main ideas and subordinate ideas are linked

together through the use of lines and arrows (graphic organizer), (4) reading to find new information and verifying accuracy of generated materials, (5) writing a report using information from the web (graphic organizer) that they created, but continuing planning as they write, and (6) checking to be sure that they used everything they wanted from the web (graphic organizer) that they created.

This particular strategy was selected because of the success that several researchers cited as they used the model in their studies (Graham, Harris, and MacArthur, 2006; Harris and Graham, 1996). At the end of the six-week lesson, Graham, Harris, and MacArthur (2006) reported that the students' classroom teachers acknowledged that their time was well spent and that students had a better understanding of how to write. Graham, Harris, and MacArthur (2006) also reported that struggling writers were now taking the time to plan reports in advance and had more confidence in their own writing abilities. The lessons selected for the current study guides students through the six-step writing approach with the assistance of the classroom teacher.

Writing Strategy – SRSD

Harris and Graham (1996) indicated that one approach to improve writing skills of students with ADHD is to employ a self-regulated strategy development (SRSD) model. Graham, Harris, and MacArthur (2006) explained that the SRSD model teaches students how to apply writing strategies effectively and independently. They shared the six stages of SRSD instruction, which can be applied in any order and are interchangeable (Graham, Harris, & MacArthur, 2006). Harris and Graham (1996) explained that the six stages include

developing background knowledge, discussing it, modeling it, memorizing it, supporting it, and independently using it. The lesson selected for the current study is based on the SRSD model as it relates to the steps leading to lesson implementation. Harris and Graham (1996) further explained that stage one, develop background knowledge, should be taught and is needed to use the strategy successfully. Stage two allows students to address and discuss the strategy, purpose, and benefits. In step three, the teacher is responsible for modeling how to use the strategy and is the first to introduce the notion of self-instruction to the students. Step four requires students to memorize all of the steps, while in step five the teacher supports students' mastery of the strategy. The sixth and final step demonstrates students' ability to independently use the strategy and apply it to their writing (Harris & Graham, 1996).

Writing Strategies – STOP and DARE

De La Paz and Bock (2001) explained that using instructional strategies STOP and DARE provide opportunities for students to learn to be reflective before they start writing. De La Paz and Bock also explained that SRSD is a key component of teaching STOP and DARE. STOP asks students to suspend judgment, take a side, organize ideas, and plan more while they write. DARE is a four-step process that encourages students to develop a topic sentence, add supporting ideas, reject at least one argument for the other side and support their opinion, and end with a conclusion.

Jacobson and Reid (2010) conducted a multiple baseline across participants design study. Their study was conducted with three Caucasian male

students who were medically diagnosed with ADHD but not on any medication during their research study. The use of a graphic organizer was included on the IEP (Individual Education Plan) of one of the three students, and a SRSD model was employed. Through this model, instructors taught students how to identify their goals, continuously monitor their progress, and identify when goals have been reached (Jacobson & Reid, 2010).

There is current research that supports the use of and reported levels of impact of the SRSD model and the use of STOP and DARE to teach students how to write persuasively (Jacobson & Reid, 2010; Kiuhara, O'Neill, Hawken, & Graham, 2012). Jacobson and Reid (2010) concluded that, while using graphical representations, students spent more time planning their persuasive essays, they included more elements of the essay in their respective papers, the essay length increased, and the overall holistic quality of their essays improved. Kiuhara, O'Neill, Hawken, and Graham (2012) reported that students spent an increased amount of time planning and composing their persuasive essays both during and after instruction of the writing strategy. Kiuhara et al. (2012) indicated that the persuasive essays were longer, complete, and higher in quality. The results indicated that composing time increased from 9 minutes to 28 minutes, students supported claims much better (rather than producing unrelated content and repetition of thoughts), and overall the essays included more elements of persuasive writing (develop a topic sentence, add supporting ideas, reject possible arguments for the other side, and end with a conclusion), which resulted in a higher quality essay (Kiuhara et al. 2012).

Arguments-Counterarguments and Student Writing

Nussbaum and Schraw (2007) completed a study of 84 students in an undergraduate educational psychology course as they integrated arguments-counterarguments into student writing. Nussbaum and Schraw (2007) applied two independent variables, including a graphic organizer, and instruction based upon the criteria for a good argument. The criteria instruction focused on having a clear position, providing supporting reasons, presenting counterarguments, considering both arguments and counterarguments in the final conclusion, and organization.

The researchers provided participants with a large paper-based graphic organizer that was organized to promote the completion of both arguments and counterarguments (Nussbaum & Schraw, 2007). Data was analyzed using a univariate approach, and regression coefficients were analyzed to understand the effect of the interactions between the various variables and their outcomes. Outcomes included the number of supporting claims, counter claims, and rebuttals as compared to the use of criteria instruction and the use of a graphic organizer. Nussbaum and Schraw (2007) reported that the criteria instruction improved the complexity of the overall written essay, graphic organizers resulted in an increase in the number of rebuttals, and overall integration of arguments with counterarguments were higher with criteria instruction.

Theoretical Framework

In reading a variety of literature, three theoretical frameworks are often connected to specific and varied processes that lead to the teaching and learning

of concepts through the use of graphic organizers. The Institute for the Advancement of Research in Education (2003) identified these as dual coding theory, schema theory, and cognitive load theory. For the purposes of this study, schema theory was used as the theoretical framework because of the connections to how students will use their existing networks of information (schema) to build new knowledge (Lorenz, Green, & Brown, 2009). Other studies also reference how the use of graphic organizers assists students as they build a schema of concepts through graphical representations (DiCecco & Gleason, 2002; Lorenz, Green, & Brown, 2009; and Unzueta, 2009).

Schemata. British psychologist Sir Frederic Bartlett was the first to introduce the concept of *schema.* Schema explains that people reconstruct stories when recalling them based on their own knowledge, experiences, and culture. Bartlett believed that one's schemata or unconscious mental structures, represented an individual's general knowledge about the world. He believed that it was old knowledge that influenced new information and how it was presented. Bartlett focused his attention on how individuals remember and what they remember.

Schema Theory. Another theorist connected to this learning theory is Jean Piaget, who studied scientific reasoning. In 1926 Piaget referenced schema, but later it was R. C. Anderson who fully developed this concept as schema theory. Schema is a cognitive framework that focuses on the knowledge and how that information is then processed, organized, and recalled. In explaining schema, Harrinton, Holik, and Hurt (1998) stated that within our

memory exists schemas or networks of information. Schema theory is based on using prior knowledge to continue building on and organizing these ideas in meaningful ways that represents ones understanding. (DiCecco & Gleason, 2002).

Through the use of graphic organizers, teachers can build schema in students by supporting them as they build and organize their ideas and collect new information. In connecting schema theory to graphic organizers, Harrington, Holik, and Hurt (1998) explained that graphic organizers assist students as they link their existing knowledge, organized in schemas, to new knowledge. Schema theory, as it connects to graphic organizer research, is a process used as individuals understand life's experiences and how they use schemata to inform future thinking and actions (Erdogan, 2009).

Improvements on Previous Literature

Previous graphic organizer studies reported common limitations within the studies. These limitations included sample size, treatment time, participation vs. performance, and generalizability (Blankenship et al., 2005; Crooks, White, & Barnard, 2007; Ives, 2007).

Crooks, White, and Barnard (2007) suggested that their study had limitations related to its small sample size. Small sample sizes limited the researchers' ability to generalize the results. Crooks, White, and Barnard (2007) asserted that a larger sample size would have made it possible to identify the main effect of the study. Ives (2007) also noted small sample size as a limitation. In Ives' study, the small sample size covered only a small number of disabilities.

A larger sample size would allow the researcher to test whether organizers had an impact on students with specific reading, writing, and language disabilities. The current study attempts to expand sample size by including four different classrooms within two different school settings.

Researchers also indicated that short treatment time makes it impossible to generalize results beyond settings that last longer. Crooks, White, and Barnard (2007) reported that the treatment for their study lasted 60 minutes, while Lorber (2004) reported that her study spanned a total of five weeks. Unzueta (2009) reported that his study had to end shorter than anticipated due to delays with spring break and the end of the year. Consequently, all researchers acknowledged that their studies could not be generalized to studies that occur over a longer period of time. In an effort to address this, the treatment for the current study is comprised of two lesson plans that each include four 50-minute lessons and the duration of the study is 12 weeks. However, due to the nature of the current study being conducted in a school the study would always be limited to occur only within the specified quarter and could not last longer.

In addition to small sample size reported earlier, Ives (2007) also noted investigator-led vs. instructor-led instruction as a limitation. Actual instruction in the Ives (2007) study was provided to students by the investigator (researcher) rather than by the classroom teacher. Ives (2007) indicated that students appeared to do better when the investigator provided the instruction. Ives (2007) did not speculate on why this happened but indicated that, for future research, it should be addressed. Ives (2007) simply stated that if this is not addressed, the

purpose of the intervention is lost. This current study will require that the respective classroom teachers administer the lessons.

Researchers revealed that they did not include a control group in their study and as a result, this limited their ability to generalize the results. For example, Blankenship et al. (2005) identified students who had difficulty with independent reading by providing a treatment of graphic organizers. However, there was no comparison group tested without organizers. Blankenship et al. (2005) recommended that future studies include a comparative research design. To address this limitation, the current study will include a comparison group, and digital graphic organizers will be compared to the use of paper-based graphic organizers. In reviewing graphic organizer research connected to writing, the studies examined were situated in middle school classrooms (Lorber 2004; Unzueta, 2009). Therefore, these studies could not be generalized to elementary level students. Unzueta (2009) recommended that future research on persuasive writing and graphic organizers focus on students in elementary schools. The current study will focus on fourth and fifth grade students aged eight through nine and 10-11.

Conclusion

Several existing studies on graphic organizers focus on how organizers are used to enhance text comprehension and increase learning among students with learning disabilities (Blankenship et al., 2005; DiCecco & Gleason, 2002; Hudson, Lignugaris-Kraft, & Miller, 1993; Ives, 2007). While there is research on graphic organizers, in general, a few studies address the use of

computer-assisted or digital organizers but they focus on using partial versus fully completed graphic organizers, note-taking, and retention of information (Crooks, White, & Barnard, 2007; Robinson, Katayama, et al., 2006).

The Institute for the Advancement of Research in Education (2003) reported that scientifically based research revealed that there is a research base that supports the use of graphic organizers for improving learning and performance with diverse students across a broad range of content areas, skill areas, and cognitive levels (Blankenship et al., 2005; Burgess, 2008; Chiou, 2008; Crooks, White, & Barnard, 2007; Franciscone, 2008; Gerstner & Bogner, 2010; Hay, Kinchin, & Lygo-Baker, 2008; Lorber, 2004; Robinson & Katayama, 2000).

Blankenship et al. (2005) revealed that graphic organizers, like Inspiration Software, have been proven to be effective learning tools. Blankenship et al. (2005) also indicated that there is a lack of literature on using digital graphic organizers.

There have been studies where the use of graphic organizers did not result in significant differences in developing supporting details (Lorber, 2009) or where the use of graphic organizers only resulted in minor increases in the mean score of arguments (Unzueta, 2009). However, the overall findings indicate that the use of graphic organizers led to improvements in the retention of information (Blankenship, et al, 2005); significantly more relationship knowledge statements (Dicceco & Gleason, 2002); better results in summary notes when using a spatially large graphic organizer and better results in verbatim notes when using

a smaller graphic organizer (Crooks, White, & Barnard, 2007); improvements in prewriting (Sturm & Rankin-Erickson, 2002); more ideas being generated and improvements in the quality of the goal/thesis statement, reasoning statements, and examples (Lin, Strickland, Ray, & Denner, 2004); higher overall scores (Lorenz, Green, & Brown, 2009); and an increase in the final grade and students' ability to organize ideas (Lorber , 2004). In terms of motivation, graphic organizers assist students by providing structure and relieving boredom (Drapeau, 1998), keeping them focused and organized (Harrington, Holik, & Hurt, 1988), raising their enthusiasm (Etchison, 1995), and increasing the motivation for students to write (Cook, et al., 2001).

Examining the impact of paper-based and digital graphic organizers on the persuasive writing process is important as it will inform teachers on how to best support students as they write. The study's significance also lies within its opportunity to explore the advantages of both paper-based and digital graphic organizers on the persuasive writing process of elementary level students. This new information also provided an opportunity to determine which organizer type works best given the demographics and writing outcome of the study.

CHAPTER 3

METHODOLOGY

The purpose of the current study was to examine and further research the impact of digital graphic organizers, as compared to paper-based organizers, as a tool to improve persuasive writing of fourth and fifth grade students. This research explored student perceptions toward writing when using digital graphic organizers and paper-based organizers. In addition, the research investigated differences in the quality of persuasive writing essays when using digital graphic organizers as compared to paper-based graphic organizers. Student essays were scored using a persuasive writing rubric, and the scores assigned were utilized to determine the impact of both paper-based graphic organizers and digital graphic organizers on the elements of quality and overall scores of the written persuasive essays.

Research Questions

This study addressed the following questions related to the overall quality of writing.

1. Is there a significant difference in the pre- and post-test scores, of the elements listed below, when fourth and fifth grade students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

    a. Is there a significant difference in pre- and post-test scores in how well the goal of the paper is written when fourth and fifth grade students develop persuasive writing essays when using digital

graphic organizers as compared to paper-based graphic organizers?

b. Is there a significant difference in pre- and post-test scores in the number of quality statements written that provide sound reasoning when fourth and fifth grade students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

c. Is there a significant difference in pre- and post-test scores in the number of quality statements written that provide sound supporting arguments when fourth and fifth grade students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

d. Is there a significant difference in pre- and post-test scores in how well students summarize personal opinions in a strong concluding statement when fourth and fifth grade students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

e. Is there a significant difference in the overall pre- and post-test scores when fourth and fifth grade students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

f. Is there a significant difference in the pre- and post-test scores, based on age and gender, when fourth and fifth grade students

develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

2. Is there a significant difference, in the following elements listed below, when using digital graphic organizers as compared to paper-based organizers:

a. Is there a significant difference in the organization of the essay when fourth and fifth grade students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

b. Is there a significant difference in the choice of words (tone) that are descriptive, leading to a consistent persuasive tone, when fourth and fifth grade students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

c. Is there a significant difference in the number of spelling errors when fourth and fifth grade students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

d. Is there a significant difference in the number of grammatical errors throughout the essay when fourth and fifth grade school students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

e. Is there a significant difference in the choice of words (tone), organization of the essay, number of grammatical errors, and

number of spelling errors, based on age and gender, when fourth
and fifth grade students develop persuasive writing essays using
digital graphic organizers as compared to paper-based graphic
organizers?

3. Do student perceptions toward the writing assignment differ when using
digital graphic organizers as compared to paper-based graphic
organizers?

Sample

The current study took place in three fourth grade classrooms and one
fifth grade classroom in Central Illinois.   The three fourth grade classrooms were
located at Woodson and Tillman School in the public school system, and
Northington School, which is a private school. The fifth grade classroom was
also located at Woodson School. The following student demographic information
was collected: gender, age, race/ethnicity, and any known learning disabilities.
Due to the gap in literature that studies graphic organizer use with elementary
grade level students and at the recommendation of Unzueta (2009), the current
study focused on fourth and fifth grade students.

Demographics

The demographics (Table 1) of the current study revealed the following
backgrounds of students: 58% were white and 42% were non-white. In the
current study 51% are aged 8-9, 49% aged 10-11, and 52% were females.
Eighty-eight percent had no documented learning disabilities, while 12% had a
documented disability.

Table 1

Student Demographics (n=67)

Variable	n	%
Age group		
8-9	34	51
10-11	33	49
Gender		
Male	32	48
Female	35	52
Disability status		
No documented disabilities	59	88
Emotional Disturbance	2	3
Learning/Processing/possibly dyslexia	1	1
Learning disability	1	1
Speech or Language disability	4	6
Race/Ethnicity		
Asian	5	8
Asian/Middle Eastern	2	3
Black/African American	15	22
Latino/a	1	1
Multiracial	5	8
White	39	58
Socioeconomic Status		
Free	16	24
N/A	25	37
Paid	23	34
Reduced	3	4
School Type		
Public	42	63%
Private	25	37%

Note. Socioeconomic status collected from students in public schools only and based on free and reduced meals (FARMS) data.

The fourth grade classrooms at Woodson School had a total of 25 students with 11 participating in the actual study. In terms of race/ethnicity, 60% of the students were White, 4% Black, and 10% Multiracial/Ethnic. Of the classroom population included in the current study, none of the students had documented disabilities and 45% were students from low-income families based on FARMS data. The Illinois State School Profile (2012) reported that 72% of fourth grade students at Woodson School met or exceeded the state standard on the statewide Illinois Standards Achievement Test (ISAT).

The fifth grade classroom at Woodson School had 21 students with 16 that participated in the current study. In terms of race/ethnicity, 50% of the students were White, 25% Black, 6% Asian, and 19% Multiracial/Ethnic. Of the classroom population included in the current study, 19% were students with disabilities and 50% were students from low-income families. When administered the ISAT, 86% of fifth grade students at Woodson School met or exceeded the standard (Illinois school profile, 2012).

The fourth grade classroom at Tillman School had 24 students with 15 that participated in the actual study. In terms of race/ethnicity, 66% of the students were White, 20% Black, 7% Asian, and 7% Multiracial/Ethnic. Of the classroom population included in the current study, 27% were students with disabilities and 47% were students from low-income families. At Tilman, 59% of fourth grade students met or exceeded the standard when administered the statewide Illinois Standards Achievement Test (ISAT). (Illinois school profile, 2012).

The fourth grade classroom at Northington School has 30 students with 25 that participated in the current study. In terms of race/ethnicity, 64% of the students were White, 16% Black, 12% Asian, and 8% Asian/Middle Eastern. Of the classroom population, 4% were students with disabilities and none of the students were from low-income families.

Students were randomly assigned, within the class, in terms of when they received each subsequent treatment of using either a digital graphic organizer first or a paper-based graphic organizer first. Based on their writing ability, assessed through the pre-test scores, students were stratified into ability groups based on extremely high, mid-level, and low scores within treatment groups. Students who were absent during the assignments had opportunities to make up the lesson. Several attempts were made for students to make up assignments but scheduling made it difficult in the missing data cases. Students were removed from the study after a week of unsuccessful attempts and when the missing data was not collected for a paired comparison.

Added Analysis Based on Demographics

In the current study, 51% of students were aged 8-9 and 49% were aged 10-11. For gender, 52% were females and 48% were males. Due to the even distribution of age and gender-related data, the demographic information was analyzed to determine the statistically significant differences in the quality of writing.

Data Analysis Procedure

During the current study, a baseline pre-test, two post-tests, and student interviews were administered. Descriptive statistics were used to describe the sample (n=67) that included frequency counts and percent statistics computed for the following demographic variables (Table 1) included in the current study: Gender, Age, Learning Disabilities, and Socio-economic Status.   Paired sample t-tests were used to test research question one and independent samples t-test were used to test research question two.

Research Design

The research study utilized a quasi-experimental study with a comparison (control group) design with a pre-test and post-tests. The switching replication method was used to strengthen the research design by administering a treatment at a later date to the group that originally served as an alternative comparison group.

For purposes of the current study, when referencing these groups in context of pre-test to post-test 1 the following terms are used: Digital First/PS (DF/PS) and Paper First/DS (PF/DS). The Digital First/PS group refers to students that utilized a digital graphic organizer first for the first writing assignment they completed at post-test 1. Those students labeled Paper First/DS utilized a paper-based graphic organizer for the first writing assignment, which was administered at post-test 1. The term first, signifies the type of graphic organizer that was administered at post-test 1.

When referencing these groups in context of pre-test to post-test 2 the following terms are used: Recent Digital Use/Prior Paper Use (RDU/PPU) and Recent Paper Use/Prior Digital Use (RPU/PDU). RDU/PPU indicates that at post-test 2 a digital graphic organizer was used and previously, at post-test 1, a paper-based graphic organizer was used. RPU/PDU indicates that at post-test 2 a paper-based graphic organizer was used and previously, at post-test 1, a digital graphic organizer was used.

When referencing these groups in context of post-test 1 to post-test 2, the following terms will be used: Digital First & Recent Paper Use/PDU and Paper First & Recent Digital Use/PPU. This indicates the type of graphic organizer used for the first writing assignment (post-test 1), and then the type of graphic organizer used for the second writing assignment (post-test 2).

Pre-tests give us an opportunity to better understand the various differences between the groups and the variability between these groups at the outset of the current study. These differences provide an opportunity to make a direct correlation to the possible outcome of the statistical analysis. This alerts the researcher to the possibility of potential threats to internal validity. While selection bias remained a limitation to this current study, the existence of both a pre-test and comparison group revealed the size and characteristic of any potential biases. Results, including tables, of the pre-test comparisons for the current study will be addressed in the data management section of chapter four.

Materials

The current study included lesson plans with persuasive writing prompts, persuasive writing scoring rubrics, consent forms, treatment fidelity procedure sheets, data logs for student interviews, computer hardware, Inspiration software (digital graphic organizer), and paper-based graphic organizers. Persuasive writing lesson plans used for the current study were selected from ReadWriteThink.org, a website developed by the National Council of Teachers of English (NCTE) and the International Reading Association (IRA). Selected lessons include Dear Librarian: Writing a Persuasive Letter and A Case for Reading — Examining Challenged and Banned Books.

Writing Prompt Baseline Pre-test – Persuading the Principal

A lesson plan titled Persuading the Principal: Writing Persuasive Letters About School Issues was used for the baseline pre-test writing prompt. The lesson plan developed by NCTE and IRA's ReadWriteThink website was adapted for use in the current study. Based on modifications, the lesson targets students in fourth and fifth grade and the estimated time for completion includes four 50-minute sessions. The writing prompt will ask students to write a letter to their school principal requesting that a new program or afterschool activity be added to the current list of offerings for students.

Writing Prompt Post-test– Dear Librarian

A lesson plan titled Dear Librarian: Writing a Persuasive Letter (Fink, 2011) was used for both the treatment and comparison groups. The lesson plan developed for NCTE and IRA's ReadWriteThink website was adapted for use in the current study. Based on modifications, the lesson targets students in fourth and fifth grade; the estimated time for completion includes four 50-minute sessions. The writing prompt asked students to write a letter to their school librarian requesting that a specific book be added to the school library collection. This lesson was used at post-test 1.

Writing Prompt Post-test— A Case for Reading

A lesson plan titled A Case for Reading — Examining Challenged and Banned Books (Fink, 2011) was used for both the treatment and comparison groups. The lesson plan developed for NCTE and IRA's ReadWriteThink website was adapted for use in the current study. Based on modifications, the lesson targets students in fourth and fifth grade; the estimated time for completion includes four 50-minute sessions. The books selected and used as discussion items were age appropriate and based on literature that the students were familiar with. The writing prompt asked students to write a persuasive essay that states what they believe should be done with a book of their choice that has been challenged. This lesson was used at post-test 2.

Persuasive Writing Scoring Rubric

A rubric was used to assess the goal statements, reasoning statements, supporting arguments, conclusion statements, organization, word choice, spelling errors, and grammatical errors. Prior to writing the persuasive essay, the scoring rubric was shared with students. This allowed students to review, in advance, how their persuasive writing essays will be scored. The rubric allowed the evaluators to respond to and score the content and quality of students' persuasive writing essays. The evaluators looked for indications that the students provided strong persuasive evidence for their essays and applied lessons learned from their graphic organizers as they gathered information for their persuasive writing essay and prepared the final version of their essay.

Assessment Measures

The current study included both quantitative and qualitative data. The quantitative data included numeric scores from the overall results of pre-test and post-test persuasion essays and numeric scores from specific components of the pre-test and post-test based on the rubric such as the goal statements, reasoning statements, supporting arguments, conclusion statements, organization, tone, spelling, and grammatical errors. The qualitative data included student responses to the open-ended interview questions following the completion of a post-test persuasion essay. The following section describes how each assessment measure was developed and how the data was collected.

Pre-test/Post-tests

The pre and post-test lessons were selected and based on a well-known teacher-tested website, ReadWriteThink, developed by the two leading professional associations for English language arts: the National Council of Teachers of English and the International Reading Association. The selected lessons guide students through an authentic learning experience where they plan, write, and support their thinking through a persuasive essay. Authentic learning experiences are those that emulate real-world situations. The lessons were selected because of their authentic tasks, the ability to incorporate the use of both paper-based and digital graphic organizers into the lessons, and because the persuasive writing rubric could be applied to the writing prompts, providing an opportunity to identify a cumulative score by collecting the following data from pre- and post-tests: goal statements, reasoning statements, supporting arguments, conclusion statements (summary of personal opinions), organization, choice of words that are descriptive, number of grammatical errors, and number of spelling errors. Lessons used in the current study were adapted to include a specific instructional strategy, STOP and DARE (De La Paz & Graham, 1997). STOP and DARE assisted students as they planned and wrote persuasively. This instructional strategy was selected because it provides an approach to writing that focuses on both reflection and planning (De La Paz & Graham, 1997).

Based on the research design, different writing prompts were used for the baseline pre-test and post-tests. All writing prompts were selected from the

National Council of Teachers of English and the International Reading Association's Read, Write Think website. Although the selected writing prompts used for pre- and post-tests were different in content, they were modified to ensure they were developmentally appropriate for students in fourth and fifth grade classrooms. This website was selected because all lessons and prompts have been teacher-developed and implemented with students.

Essay Scoring

Scores from the persuasive essays assisted with measuring growth, or lack thereof, when using digital graphic organizers as compared to a paper-based organizer. Two evaluators completed the essay scoring and provided double-rated essays to ensure reliability of the scoring procedures. The two evaluators were retired educators who taught persuasive writing to students and were still active in the field of education as they speak at education conferences and provide professional development services to schools and districts. In addition, they have received extensive professional development on how to integrate technology into the curriculum, they served as instructors for a district-wide certificate program for technology integration, and they were fellows in a satellite program of the Maryland Technology Academy – a Leadership Academy for Teachers that focused on technology skills.

The evaluators scored essays by (1) analyzing and identifying how well the goal of the paper was written, (2) the number of quality statements written that provided sound reasoning, (3) the number of quality statements written that provided supporting arguments, (4) how well the students summarized personal

opinions in strong conclusion statements, (5) how well the paper was organized, (6) the tone/choice of descriptive words leading to a consistent persuasive tone throughout the letter, (7) the number of spelling errors, (8) the number of grammatical errors, and (9) the overall score of the essay.

Reliability Analysis

The scoring rubric used in the current study was adapted from a scoring rubric retrieved from the ReadWriteThink website that was previously tested in a classroom. For content validity, classroom teachers reviewed the scoring rubrics and provided feedback prior to use in the classrooms. Prior to the current study, three classroom teachers with experience teaching elementary level students reviewed and provided feedback on the scoring rubrics. All teachers indicated the scoring rubric components were appropriate for use in fourth and fifth grade classrooms and they offered minor suggestions based on their experiences.

Training raters to use the rubric

Prior to grading the work, the independent evaluators participated in a researcher-led session that described grading the work, in detail. This included the researcher sharing several examples of how various essays met the criteria and provided an opportunity to answer questions from the evaluators. During an hour-long virtual session, independent evaluators independently scored three different sample assignments using the scoring rubric included in the current study. Upon completion, they shared their scores and discussed their thinking that led to the final scores based on the scoring rubric and information provided by the researcher. As the session culminated, it was clear, through consistent

scoring on all three of the sample essays and the dialogue that followed, that the evaluators fully understood the expectations of the work.

Interrater reliability on Use of a Rubric. For interrater reliability, the two evaluators independently graded the student essays using a scoring document based on the rubric. After independently scoring the student essays, they met to compare their scores and they discussed areas of disagreement until they reached consensus. Based on the combined evaluations by the independent evaluators, prior to reaching consensus, there was a 3.85% disagreement on the goal statement scores, 4.61% disagreement on the reasoning statement scores, 6.92% disagreement of supporting argument scores, 11.54% disagreement on the concluding statement scores, 13.85% disagreement on the organization scores, 10% disagreement on the tone scores, 0.77% disagreement on the spelling error scores, and 0.77% disagreement on the grammar scores. There was at least 90% agreement on scores for the goal statements, reasoning statements, supporting arguments, tone, spelling, and grammar. Initially, 90% was not achieved for the conclusion statements and organization. As a result, evaluators revisited the rubrics from the training session and discussed the results, which led to a consensus. There was overall agreement in over 85% of the combined outcomes by the two independent evaluators.

Completed Graphic Organizer/Transfer of Ideas

The researcher reviewed both paper-based and digital graphic organizers to confirm whether or not students utilized a graphic organizer in the planning stages to help with the development of the persuasive essay. During this

process, the researcher looked to identify the total number of reasons and support statements that were transferred from the graphic organizer to the final persuasive writing essay. This information was collected and tallied, by the researcher, for further analysis if patterns appeared that revealed that students did not use graphic organizers for planning their persuasive essays. In the current study, only one student did not transfer the reasoning statements and supporting arguments. Students understood they were to use the graphic organizer to organize and plan essays. They were also reminded that they could add more reasons and supporting ideas to their essay.

Evaluator Training

To ensure that the training was effective and to strengthen interrater reliability, evaluators participated in an hour long required professional development session that provided them with scoring rubrics, sample essays, sample scored essays, and detailed explanations on how to rate participants' persuasive writing essays using the persuasive writing rubric. The evaluator training was used to ensure that all persuasive writing essays were scored using the exact same criteria on the persuasive writing rubric. The training provided guidance on how to score essays based on specific components within the essay. The researcher described and provided examples on the different components of the scoring rubric and provided sample essays. During the training session, evaluators rated three sample essays, independently, using all of the components of the scoring rubric. This step occurred in preparation for and prior to the current study. After testing, for agreement, they had an opportunity to

reflect on what they learned about the various details provided in the rubric and share why they assigned specific scores. An agreement meant that they agreed on the score they believe each student should receive. If they did not agree during the sample essay portion, they would have an opportunity to discuss the disagreement and revisit the scoring rubric in hopes of reaching a consensus. The evaluators had opportunities to ask questions and scored sample essays for practice prior to receiving the actual essays. Immediately after scoring the sample essays, evaluators discussed why they scored the essays the way they did based on the scoring rubric. During the scoring of the sample essays, there were no disagreements between the evaluators. If disagreements were to arise, the researcher was prepared to provide clarification to ensure evaluators clearly understood how to apply and utilize the rubric, and the evaluators would have been asked to work toward a consensus through active participation in a professional dialogue about the overall scoring. During the evaluator training, the results were documented to ensure that both evaluators achieved a minimum level of competence of sample essays. This documentation confirmed that they were able to independently evaluate and score essays, accurate to one another, based on the rubric.

The professional development opportunity also provided a double-rate system to assess the reliability of the scoring rubric. If differences occurred in scores, the two evaluators were prepared to resolve those differences through a discussion leading to a consensus. In the event no consensus was reached, the

researcher was prepared to review and evaluate essays, consider feedback from the evaluators, and then intervene by providing a final score.

Interrater Reliability of Evaluator Training. For the current study, interrater reliability was the level of agreement, using a rubric, of the two independent evaluators as they score persuasive writing essays. As evaluators double rate, a score for interrater reliability will be determined by dividing the number of agreement on the rubric by the total number of agreements and disagreements and by multiplying that number by 100 for each variable (Cooper, Heron, & Heward, 2007). Unzeuta (2009) also tested this formula in a study on graphic organizers and indicated that if a minimum of 90% interrater reliability isn't achieved, the two independent evaluators will be required to revisit training on rubric utilization and have a discussion about the essay based on the rubric. Since 90% was not achieved during the current study, for the concluding statement and organization, the two independent evaluators were required to revisit training on rubric utilization. After revisiting the rubrics from training they participated in a joint discussion that led to consensus about specific outcomes based on the rubric. After this step, if 90% was not achieved, the researcher would serve as a third party and take the mean of the two scores to determine the final score.

Validity

A panel of five certified teachers, not associated with the students in the study, reviewed the rubric for the current study. Their review of the rubric provided information on whether or not teachers understood the scoring rubric,

their perceptions of whether or not students would understand the scoring rubric, and recommendations to strengthen the scoring rubric. Overall, the teachers felt the scoring rubric was developmentally appropriate for fourth and fifth grade students and as teachers they understood the categories. However, based on experiences with rubrics they recommended the following enhancements: consider using either goal or thesis, replace illegible in the spelling and grammar box, for organization consider the language transition statements, consider tone appearing in sequence after organization, and consider using the wording language conventions to encompass both spelling and grammar.

Qualitative Data Collection: Student Interview Questions

Student interview data logs, along with audio recordings, were used to compile and organize data collected from students on their perceptions toward the writing assignment when using digital graphic organizers as compared to paper-based graphic organizers. The researcher was responsible for interviewing students and collecting data from the open-ended questions. Results from the pre-test provided guidelines, along with teacher feedback, for the selection of a sampling of students to be interviewed from a range of mixed abilities. Using the pre-test scores and teacher feedback, the researcher selected six students — two high performers, two average, and two low performers, from each classroom as the sample of students selected for interviews.

Semi-structured interviews were used as the qualitative method of collecting information from students through open-ended questions. In the current study, the open-ended questions were selected based on previous research on the use

of digital graphic organizers and the writing process (Lorber, 2004). In addition, the following questions were selected based on each component of the scoring rubric to understand student beliefs about learning objectives:

1. As you wrote the essay, what strategies or methods did you use to develop your goal (personal opinion), reasoning statements, and supporting arguments for each reasoning statement?

2. As you look at the various items on the scoring rubric (goal statements, reasoning statements, supporting arguments, organization, spelling, grammar, word choice/tone, and conclusion statements), did the graphic organizer help you? If yes, how?

3. Can you tell me about your learning processes, or what helped you as you completed this assignment?

Open-ended questions provide student perspectives on specific methods used during the planning and writing process, specific challenges faced during the writing process, perceptions about personal improvement, and student perspectives on the use of paper-based and digital graphic organizers. According to Stake (2010), interview questions also provide an opportunity to obtain unique information or interpretation from individuals being interviewed. For the current study, the following eight open-ended interview questions were selected based on a previous study by researcher Lorber (2004):

1. When you wrote the essay, what process did you use to develop details and examples for each main idea?

2. When you wrote the essay, what process did you use to organize your ideas?

3. What part of your writing would you like to improve?

4. When is writing easy for you and what are some of the easier things about writing?

5. When is writing hard for you and what are some of the hard things about writing?

6. How do you think learning and using the digital graphic organizers helped you? Explain.

7. How do you think using digital graphic organizers caused a delay or made it difficult for you to complete the persuasive writing assignment? Explain.

8. When you wrote your essay, what process did you use to help you come up with ideas for writing the final essay?

The current study utilized interview questions that were previously tested in graphic organizer research (Lorber, 2004), which focused on eighth-grade students' ability to write text. To ensure that students understood the questions, each question was designed to be developmentally appropriate for the ability levels of the students being interviewed. In other words, the vocabulary selected was age appropriate and students were also asked if they understood the question. If not, the questions were re-stated using simpler terms. Using similar questions, as the Lorber (2004) study, provided an opportunity to be able to compare findings between studies. Prior to the utilization of the interview questions, the researcher piloted the questions with a fourth and fifth grade

student who was not associated with the current study. As a result of this pilot, it was determined that certain words, by request, would be delivered with both the word and the definition of the word to ensure that all students understood the questions. The interview questions were designed to be general, which provides an opportunity for students to address all aspects of why they planned and wrote the way they did while addressing their individual successes and challenges with the assignment. Coding student responses to open-ended questions allowed the researcher to look for the following themes: (1) how supporting details were developed, (2) how ideas were organized, (3) areas of improvement, (4) whether or not digital or paper-based graphic organizers make writing easy, (5) whether or not digital or paper-based graphic organizers make writing difficult, (6) perceptions on the use of digital graphic organizers, and (7) strategies and/or tools used to assist with idea generation.

The data from the interview questions assisted the researcher not only in providing informative and useful feedback based on student perceptions, but in providing an opportunity to support an assertion about the use of paper-based and digital graphic organizers and their impact on persuasive writing.

During the current study, 25 questions were written (as noted in Appendix H), however, only five questions were analyzed for the current study. The questions selected for analysis were directly connected to the research questions (as noted in Table 17) and directly addressed the impact of digital and paper-based graphic organizers on persuasive writing.

Piloting the Student Survey. In an effort to ensure that the survey was developmentally appropriate for students involved, the researcher piloted the questions with a fourth and fifth grade student who had no association with the current study. The researcher completed these mock interviews to better understand if students would understand the questions and if the questions would result in the type of responses the researcher was expecting. As students responded to pilot questions, the researcher had an opportunity to determine if there was a need to develop additional questions, omit, and/or revise questions for increased clarity. After the pilot stage, the researcher added the following questions to parallel the same questions asked about digital graphic organizers: How did using a paper-based graphic organizer help you? How did using a paper-based organizer hinder you? To get a better understanding of student perceptions when using paper-based and digital graphic organizers students were asked which graphic organizer type they preferred to use. Overall, through this pilot, the researcher gained a better understanding of alternative language used to present the questions to students for clarity. For example, while some students understood the word "hinder," the pilot prepared the researcher to be prepared to explain hinder or restate the question using simpler terminology.

Quantitative Analysis — Rubrics (Scoring Procedure Documents)

Persuasive essays used for the pre- and post-test were collected from students and scored using a rubric (scoring procedure document) that asked the evaluators to provide assessment data for different components within the rubric such as goal/thesis statements, reasoning statements, supporting arguments,

conclusion statements, organization, word choice/tone, mechanics/grammar, and then overall scores based on the rubric. An analytical scoring rubric was used because it is designed to provide specific data on elements within a written composition, as compared to a holistic rubric (Moskal, 2000; Unzueta, 2009). Each component of the rubric was selected based on a sample of the most commonly used elements for assessing persuasive writing and based, in part, on the Six Trait Analytic Writing Rubric (Lorber, 2004; NCTE/IRA ReadWriteThink, 2012; Spandel, 1996; Unzueta, 2009). Each element in the rubric was analyzed to provide an overall score for each student. Persuasive essays were scored using the rubric and based on a scale of one to four, with four being excellent.

The rubric (as noted in Appendix D) for the current study guided both students and those assessing the work as they identified the following: (1) Was the goal/thesis strong and clear, with a personal opinion conveyed? (2) Were there three or more excellent points made with good support and reasoning statements? (3) How well did students summarize personal opinions in a strong concluding statement? (4) How many sentences were complete, well written, and varied? (5) Were paragraphs complete, well written, and varied? (6) Were word choices clear, descriptive, and accurate while maintaining a consistent persuasive tone throughout the letter? (7) How many spelling errors are there throughout the letter? (8) How many grammatical errors are there throughout the letter? Full explanations for rubric categories are provided in Appendix D.

Studies on persuasive writing and argument-counterargument explain that how well students provide organization, reasoning and support, main ideas,

and/or strong concluding statements are elements that strengthen persuasive writing (Davies, 2008; De La Paz & Graham, 1997; Jacobson & Reid, 2010; Mason, Benedek-Wood, & Valasa, 2009; Nippold, Ward-Lonergan, & Fanning, 2005; Nussbaum & Schraw, 2007).

Researcher's Role

The researcher served as the lead research associate and instructional technologist. As lead research associate, the researcher conducted the student interviews, provided lesson plan scripts, trained students and teachers on the use of Inspiration Software, and developed training for the evaluators. The researcher was not responsible for developing the lessons or evaluating and grading student work.

Procedures

The current 12-week study included a pre-test (baseline assessment) and post-test essays. The essays were administered by the classroom teachers to students in fourth and fifth grade in two different public schools (Woodson School and Tillman School) in the Central Illinois area, and in one private school (Northington) located in the Central Illinois area. Two independent evaluators assisted with the scoring of the persuasive writing essays.

Prior to data collection, IRB approval was secured from both Towson University and the respective school systems, and parental consent forms were signed and submitted. Upon IRB approval, a meeting took place between the researcher and the respective classroom teachers to review the research plan and to discuss the best process for collecting relevant student data. Students

who missed class on the day of the lesson had opportunities to make up the lesson. A total of six students were unable to make up lessons before the culmination of the current study. As a result, these students were not eligible for inclusion in the final study and their student data was removed.

Prior to the current study and over a two-week span, the lead researcher met with the two independent evaluators to discuss the research implementation plan. In addition, the researcher provided a training session which included both a verbal explanation and detailed written instructions on how the writing rubric should be utilized, how to document student scores using the essay scoring document, and addressing interrater reliability between the two evaluators. Interrater reliability is the degree in which two or more raters agree after observing or scoring the same event (Cooper et al., 2007). The evaluators received training on how to rate the student essays based on the ten components within the scoring rubric. During the training session the independent evaluators received information on how to score persuasive writing essays using the rubric and how best to document student scores on the persuasive writing scoring sheet. Evaluators participated in a session that allowed time to practice scoring essays using sample compositions provided by the researcher.

Consent forms were included to ensure that students and their parents provided consent to participate in the current study. Parents were provided with information about the current study, including student expectations. The

procedure sheets provided step-by-step instructions on how lessons should be carried out to ensure consistency of delivery. The researcher was responsible for completing a checklist that identified whether or not all procedures and protocols were followed. As for computer hardware, students used computers provided by the school system. Students used district-approved software, Inspiration. A persuasion map planning sheet helped guide students in mapping out their goal/thesis statements, main reasons, supporting arguments, and conclusion statements for the persuasive writing assignment. Using Inspiration, digital graphic organizer software, students created a digital graphic organizer that focused on persuasive elements. The digital graphic organizer guided students through planning, organizing, and writing a persuasive writing essay using visual elements.

Each procedural step listed below occurred at all school settings within a three-week range:

- Weeks 1 and 2 — Students took a pre-test that assessed their current writing ability without a graphic organizer. The pre-test consisted of the development of a persuasive writing essay that revealed whether or not any significant differences exist at the outset of the current study. The pre-test also provided a data set for comparison between the post-test results revealing whether or not there were statistically significant changes in the quality of writing based on the persuasive writing rubric.

- Week 3 — The researcher provided a training session for both students and teachers on how to use and develop digitally based graphic organizers using Inspiration Software and how to use a paper-based persuasive writing graphic organizer. Classroom teachers and students received two one-hour training sessions on the basic use of Inspiration Software focusing on selecting, creating, manipulating, saving, printing, and enhancing via websites, video, audio, graphics, spell check, and thesaurus use. The paper-based graphic organizer training was scheduled for two one-hour training sessions that focused on planning and utilizing areas on the paper-based organizers. When using paper-based graphic organizers, students and teachers were made aware of how they could utilize and document the use of additional resources such as tape recordings, videos, dictionaries, thesauruses, and the Internet on the paper-based graphic organizers. Each training session occurred for the appropriate student groups (paper-based graphic organizer or digital graphic organizer) prior to the implementation of the persuasive writing lessons.

- Weeks 4 and 5 — Students within a classroom were randomly assigned, by the researcher, to one of the two conditions being examined within the current study. Some of the students, through the random assignment, were asked to compose the persuasive essay titled Dear Librarian with the use of a digital graphic organizer while some students utilized a

paper-based organizer for the same essay. Classroom teachers implemented this lesson using a detailed step-by-step lesson plan. In an effort to ensure that each group was equitable as it relates to the student writing ability, the researcher randomly assigned students with extreme scores on the baseline essay equally to both control and comparison groups (Lorber, 2004).

Based on writing ability—which was assessed through the pre-test scores—the researcher reviewed all scores and stratified students with extremely high scores, extremely low scores, and mid-level scores between both groups (paper-based graphic organizers and digital graphic organizers). According to Lowry (2012) this randomization provides an opportunity for both groups (paper-based and digital graphic organizer) to be as equal as possible, in terms of how they respond to and achieve, as a result of instruction. At the outset of the lesson, the lead researcher was responsible for observing lesson implementation to collect information on treatment fidelity using the Treatment Fidelity Procedure Sheet and Checklist (as noted in Appendix G). The checklist provided information on whether or not all steps were followed by the classroom teachers as the lesson was implemented using the lesson plan. When a particular step was skipped, the lead researcher immediately notified the teacher so the step could be addressed and the lesson redirected. During the current study, the researcher completed the treatment fidelity checklist for each classroom and all steps were followed.

After students completed their essays, two evaluators independently read, reviewed, and scored the persuasive writing essays titled Dear Librarian using the persuasive writing rubric and compiling the student persuasive writing essay scores on the persuasive writing scoring sheet. The researcher collected the scores of the evaluators and compiled, compared, and calculated the scores for interrater reliability. Based on the Unzueta (2009) study, a score for interrater reliability was determined by dividing the number of agreements on the rubric by the total number of agreements and disagreements and by multiplying that number by 100 for each variable (Cooper, Heron, & Heward, 2007). This formula resulted in a percentage of interrater reliability. If a minimum of 90% interrater reliability wasn't achieved, the two independent evaluators were required to revisit training on rubric utilization and have a discussion about the essay based on the rubric. The actual interrater reliability percentages for each outcome have been previously noted on page 53 of the current study. This step was repeated with independent evaluators as they scored a lesson entitled "A Case for Reading — Examining Challenged and Banned Books."

- Weeks 6 and 7 — Using the switching replication method, the interventions were administered in reverse order, allowing the students who previously used digital graphic organizers to compose a different essay entitled "A Case for Reading — Examining Challenged and Banned Books" using the paper-based graphic organizer. The students in the classroom that previously used paper-based graphic organizers utilized digital graphic organizers with the lesson entitled "A Case for Reading —

Examining Challenged and Banned Books." The lesson was administered during this week in four 50-minute sessions. This step was repeated at each school.

- Week 8 — The lead researcher conducted semi-structured interviews about student perceptions toward the use of paper-based graphic organizers and digital graphic organizers. This step will be repeated in each classroom.

Current Limitations

A primary threat to internal validity was the short treatment time. The current study lasted 12 weeks from beginning to end; however, in working with the schools, the actual lesson plan implementation lasted two weeks. The time span of the lesson made it difficult to generalize results from the current study that last longer than two weeks.

The primary threats to the external validity of the current study included small sample size, testing, and setting. In the current study, participants were from three different schools and two different types of school systems. In addition, the sample size was relatively small from the outset, and after consent forms were signed, the sample size became smaller, making it even more difficult to generalize the results. Students whose parents failed to provide consent were still allowed to complete the lesson. However, these students' scores were not included in this current research study and no data related to their work was analyzed.

Another limitation is that study participants were pre-tested. As a result, this altered how they responded to the treatment since they had previous exposure to it. Finally, the setting served as a limitation in that the researcher was visible in the room during the current study. This caused study participants to react differently to the graphic organizers since they were aware that they were participants in a study. To minimize this, and in accordance with the informed consent forms, students did not receive detailed specifics on the nature of the research such as its focus on observing student use of graphic organizers.

Data Analysis Plan

The baseline pre-test was administered to provide data that would lead to an understanding of the variability among students that exist prior to the intervention. A stratified random sample was created as a means to ensure that the post-intervention groups were equally distributed in terms of the ability levels of all students. Students who received extremely high, extremely low, or mid-level scores after completing the baseline pre-test were equally distributed between the intervention groups to create mixed ability groups. This was based on the overall pre-test scores and teacher feedback.

Data collected from the current study was analyzed to determine if there were any significant differences in scores across various tested outcomes for the respective research questions specific to 1) pre-test to post-test 1 improvements when using a digital organizer first and a paper organizer first, 2) pre-test to post-test 2 improvements of the following two groups Recent Digital Use/Prior Paper Use (RDU/PPU) and Recent Paper Use/Prior Digital Use (RDU/PDU), and

3) Post-test 1 to Post-test 2 improvements with a comparison of digital first and paper first groups at post-test 1, and paper second and digital second at post-test 2. Data was also analyzed to determine any differences in paper, as compared to, digital graphic organizer use at post-test 1 and post-test two.

Scores from the essays, for research question one, were collected and analyzed by the lead researcher using a paired sample t-test. Scores from the essays, for research question two, were collected and analyzed using an independent sample t-test. Data from student interviews was coded and analyzed by the lead researcher to report on student perceptions.

Paired sample t-tests and Independent samples t-tests were applied to determine significant differences based on student scores using a persuasive writing rubric. As noted in the corresponding tables, for the current study Glass' delta refers to effect size for paired sample t-tests, and Hedges' g refers to effect size for Independent samples t-tests. In the current study, effect sizes were calculated as an additional measure to quantify the difference in mean scores between two groups in the current study. This provides a measure to understand how large the relationship is between two variables (Coe, 2002). Effect size provides a standard measure of effect, by identifying the number of standard deviations that separate two variables from one another (Texas Education Agency, 2013). A small effect size signifies that there is an effect and a large effect size indicates that there is a substantial relationship between variables.

For the current study, a small effect is measured at .20, medium effect is .50, and a large effect is .80 (Cohen, 1988).

The Paired sample t-test was selected because it is used to compare the means of two related groups (students using digital graphic organizers and those using paper-based graphic organizers) while providing significance testing on all of the identified outcomes. The Independent samples t-test was selected because it is used to compare the means of subjects at the same point in time (those using paper as compared to digital graphic organizers at post-test 1 and then post-test 2.) These tests also measured significance comparisons related to gender (male and female) and age (8-9 and 10-11) for both statistical tests.

Paired sample t-tests and Independent samples t-tests were used to determine whether or not significant differences existed between students who used a digital graphic organizer and a paper-based graphic organizer on the following nine writing quality outcomes: (1) developing a clear and concise goal statement, (2) providing reasoning statements, (3) providing strong supporting arguments, (4) summarizing personal opinions in conclusion statements, (5) organization of the essay, (6) using tone/word choices that are descriptive leading to a consistent persuasive tone, (7) total number of spelling errors, (8) total number of grammatical errors, and (9) overall score based on the persuasive writing rubric.

The qualitative data from the open-ended questions was collected, organized, and coded to find patterns in the results. Auerbach and Silverstein (2003)

explained that coding qualitative data provides opportunities to make connections to the research concerns by identifying relevant data, reviewing responses for ideas that have repeated patterns, and grouping ideas in common themes. After following this process, Auerbach and Silverstein (2003) suggest summarizing the data to reveal what was learned about the research concerns. For the current study, qualitative data was collected and organized on a student interview data log (Appendix H). This process allowed the researcher an opportunity to make connections around repeated patterns related to perceptions on the following: (1) how a paper-based graphic organizer helped with writing, (2) how a paper-based graphic organizer hindered student writing, (3) how a digital graphic organizer helped with writing, (4) how a digital graphic organizer hindered student writing, and (5) overall preference of using paper-based graphic organizers or digital graphic organizers.

CHAPTER 4

RESULTS

This chapter provides documentation of the data analyses related to the three research questions and discusses the results of a quasi-experimental study with a comparison (control group) design and pre-test and post-tests. The current study includes nine writing outcome areas and a qualitative research question that were developed based on a literature review that addressed the various ways in which graphic organizers have been used to assist students with their writing and how they impact teaching and learning (Anderson-Inman, Ditson, & Ditson, 1998; Ausubel, 1960; Blankenship et al. 2005; Bruillard & Baron, 2000; Chiou, 2008; DiCecco & Gleason, 2002; Gerstner & Bogner, 2010; Hay, Kinchin, & Lygo-Baker, 2008; Kwon & Cifuentes, 2007; Meyer, 1995; Royer & Royer, 2004; Sturm & Rankin-Erickson, 2002).

Research Questions

Table 2 presents independent variables, dependent variables, and the statistical test used to test the respective research questions and significance levels. Of the nine writing outcomes, Research Question One (Table 2) entails three kinds of paired comparisons of means conducted separately within each group: 1) pre-test and post-test 1; 2) pre-test and post-test 2; and 3) post-test 1 and post-test 2 for the following content items: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores. These variables were selected for a pre-test and post-test comparison because of the researcher's interest in identifying specific instructional strategies that

could contribute to improving the structure of writing over time. The paired comparisons of means were conducted separately to provide three different analyses that would allow additional insight into whether or not graphic organizers (paper-based or digital) improved writing with a focus on the actual structure of the persuasive writing essay.

Research Question Two (Table 2) focuses on the difference in scores on post-test 1 when using digital (n=36) graphic organizers and paper (n=31) graphic organizers, and on post-test 2 when using digital (n=35) graphic organizers and paper (n=30) graphic organizers at a single point in time for the following process mechanic items: organization, tone, spelling, and grammar. These four outcomes were selected because they are variables that contribute to enhancing the overall quality of persuasive writing essays, beyond contributing to the structure of an essay.

All students had the opportunity to receive both interventions (paper-based and digital graphic organizers), as the switching replication method (Wuensch, 2003) was used. This method was used in an effort to strengthen the research design by administering both treatments at different times to different groups thereby ensuring that both groups receive all treatments. This process strengthens the research design by providing the researcher with additional data analysis methods at different intervals, as compared to a single post-test design that does not utilize the switching replication method (Shadish et al., 2000). Appendices J –T provide full data tables that include complete analyses of all nine outcome scores collected from students.

Qualitative Analysis

Upon the completion of developing writing assignments using both a paper-based and digital graphic organizer, the qualitative research question addressed the differences in students' perceptions toward the writing assignment when using digital graphic organizers as compared to paper-based graphic organizers. The question also focused on advantages and disadvantages of each type of graphic organizer.

Table 2

Independent Variables, Dependent Variables, and Statistical Techniques

RQ	IV	DV	Statistical Test
1	Time: Pre-test to Post-test 1 Digital First/PS Paper First/DS Time: Pre-test to Post-test 2 Recent Digital Use/PPU Recent Paper Use/PDU Time: Post-test 1 to Post-test 2 Digital First & Recent Paper/PDU Paper First & Recent Digital/PPU	Goal/Thesis Statements	Paired sample t-tests
1	Time: Pre-test to Post-test 1 Digital First/PS Paper First/DS Time: Pre-test to Post-test 2 Recent Digital Use/PPU Recent Paper Use/PDU Time: Post-test 1 to Post-test 2 Digital First & Recent Paper/PDU Paper First & Recent Digital/PPU	Reasoning Statements	Paired sample t-tests
1	Time: Pre-test to Post-test 1 Digital First/PS Paper First/DS Time: Pre-test to Post-test 2 Recent Digital Use/PPU Recent Paper Use/PDU Time: Post-test 1 to Post-test 2 Digital First & Recent Paper/PDU Paper First & Recent Digital/PPU	Supporting Arguments	Paired sample t-tests
1	Time: Pre-test to Post-test 1 Digital First/PS Paper First/DS Time: Pre-test to Post-test 2 Recent Digital Use/PPU Recent Paper Use/PDU Time: Post-test 1 to Post-test 2 Digital First & Recent Paper/PDU Paper First & Recent Digital/PPU	Conclusion Statements	Paired sample t-tests
1	Time: Pre-test to Post-test 1 Digital First/PS Paper First/DS Time: Pre-test to Post-test 2 Recent Digital Use/PPU Recent Paper Use/PDU Time: Post-test 1 to Post-test 2 Digital First & Recent Paper/PDU Paper First & Recent Digital/PPU	Overall Scores	Paired sample t-tests

RQ	IV	DV	Statistical Test

2	Group: Digital Post-test 1 and Paper Post-test 1
	  Digital First/PS & Paper First/DS
	Group: Paper-based Post-test 2 and Digital Post-test 2
	  Recent Paper Use/PDU & Recent Digital Use/PPU
		Organization	Independent samples t-test

2	Group: Digital Post-test 1 and Paper Post-test 1
	  Digital First/PS & Paper First/DS
	Group: Paper-based Post-test 2 and Digital Post-test 2
	  Recent Paper Use/PDU & Recent Digital Use/PPU
		Tone	Independent samples t-test

2	Group: Digital Post-test 1 and Paper Post-test 1
	  Digital First/PS & Paper First/DS
	Group: Paper-based Post-test 2 and Digital Post-test 2
	  Recent Paper Use/PDU & Recent Digital Use/PPU
		Spelling	Independent samples t-test

2	Group: Digital Post-test 1 and Paper Post-test 1
	  Digital First/PS & Paper First/DS
	Group: Paper-based Post-test 2 and Digital Post-test 2
	  Recent Paper Use/PDU & Recent Digital Use/PPU
		Grammar	Independent samples t-test

Note. RQ – Research Questions, IV – Independent Variables, DV – Dependent Variables, Digital First/PS (DF/PS) – Digital Graphic Organizer administered first/Paper-based Graphic Organizer administered second, Paper First/DS (PF/DS) – Paper-based Graphic Organizer administered first/Digital Graphic Organizer administered second, Recent Digital Use/PPU (RDU/PPU) – Recent Use of a Digital Graphic Organizer with Prior Paper Use, and Recent Paper Use/PDU (RPU/PDU) – Recent Use of a Paper-based Graphic Organizer with Prior Digital Use. Statistical tests were run for each main item (time and group) listed under IV.

Research Questions One and Two: Data Management

The total number of subjects (n=67) changed slightly when comparing different data sets. Reviewing paired t-test data connected to the comparison of the paper-based graphic organizer post-test to the digital graphic organizer post-test reveals three instances of missing data when using a paired t-test to compare pre-test to paper-based post-test (n=64), and six instances of missing data when comparing pre-test to digital graphic organizer post-test (n=61). Reviewing independent samples t-test data, revealed six instances of missing data for pre-test digital first vs. paper first, and two instances of missing data when comparing post-test 2 digital first vs. paper first. The missing data is representative of students who were absent on the day of assessment and that were unable to make up the assignment.

At the outset of the current study, the researcher reviewed the pre-test scores (Table 3) in an effort to stratify students within classes with extremely high scores, extremely low scores, and mid-level scores between both groups of students (paper-based graphic organizers and digital graphic organizers). This step was included to determine if both groups were equivalent and essentially functioning at the same level at the start of the current study. This is an important step because this ensures that any differences in mean scores at subsequent post-tests were not related to students having large variances in ability levels but actual performance as a result of the treatments. The overall pre-test mean score is 18.84 and the standard deviation is 2.73 for the digital first/paper second group. For the paper first/digital second group, the overall

pre-test mean is 18.87 and the standard deviation is 3.48. In reviewing mean scores (as indicated in Table 3) at the pre-test stage, data suggests that students in each respective group were functioning at the same level.

This same process was followed as the researcher reviewed pre-test scores (as indicated in Table 4) for each respective class. However, based on pre-test means between classes, it appears that there is variability at the outset of the study for the following outcomes: reasoning statements, supporting arguments, organization, tone, and overall scores.

There appears to be an underlying pattern between the fourth and fifth grade students in public schools for the following outcomes: reasoning statements, tone, and overall scores. It is probable that these differences exist because of the age of the students that correlates to experience. This is consistent with student reading scores on the Illinois Standards Achievement Test (ISAT) in which a larger percentage of fifth grade students (86%), as compared to the fourth grade students at Woodson (72%) and Tillman (59%) met or exceeded the standard on these statewide tests. As a result, this could be a contributing factor to the difference in communicating initial ideas and thoughts (reasoning statements) to help frame the essay, and conveying through written text more persuasive words (tone). Differences in the overall scores could be contributed to older students having an advanced vocabulary and context, based on experience, for idea development and all other remaining areas (goal statements, conclusion statements, spelling, and grammar) that encompass the overall score on the essay. Whereas the initial ability of students, regardless of

age, is a factor in adding quality supporting arguments to the initial reasons developed and understanding how to organize a written essay as this type of information, on the structure of an essay, is a regular and repeated approach to writing essays prior to this research being conducted.

Another emerging pattern appears between the public school classrooms and private school classrooms for the following outcomes: reasoning statements, supporting arguments, organization, and tone. As for differences between public and private school classrooms, while no standardized test data (i.e. ISAT) was available to compare for the private school students, it is plausible that they may have already been performing at higher levels, in specific areas, at the outset of the study based on significant differences between groups on pre-test scores. It is also plausible that there is a correlation between student performance and socioeconomic status, as measured through FARMS, of students as noted in Table 1. The data reveals that fourth grade students enrolled at Woodson (45%) and Tillman (47%), and fifth grade students enrolled at Woodson (50%) qualify for FARMS, while the private school does not collect such data as families pay tuition. It is plausible that the initial ability of students, based on age and school type, could result in overall differences of the remaining outcomes such as: goal statements, conclusion statements, spelling, and grammar.

The differences that exist between fourth vs. fifth grade students for the reasoning statements, tone, and overall scores, and public vs. private school students for reasoning statements, supporting arguments, organization, and tone were not expected to bias results because the current study is randomized within

schools and between organizer conditions, which include students from all four schools. After reviewing the pre-test scores, students in each respective class were stratified and then randomly assigned to one of the treatments (digital first or paper first) based on performance levels (extremely high scores, extremely low scores, and mid-level scores).

Persuasive Writing Content Items: Research Question One

Research Question One: Pre-test to Post-test 1 Findings

Descriptive statistics (Table 5-10) reveal pre-test and post-test data results for the goal statements, reasoning statements, supporting arguments, conclusion statements, and the overall scores for students. There were significant changes from pre-test to post-test 1 (as noted in Table 5) on all five outcomes: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores for students who used digital graphic organizers first, with medium to large effect sizes.   The group using paper-based graphic organizers first resulted in significant changes in the following three areas: supporting arguments, conclusion statements, and overall scores with large effect sizes. There were no significant differences on the goal statements and reasoning statements.

Table 3

Mean scores of pre-test, post-test 1, and post-test 2 for the Digital First/PS (DF/PS) and Paper

First/DS (PF/DS) groups

Scale	M Pre-test	SD	M Post-test 1	SD	M Post-test 2	SD
Goal Statements						
DF/PS	2.97	.18	3.08	.73	3.14	.49
PF/DS	2.93	.52	3.13	.43	2.93	.69
Reasoning Statements						
DF/PS	2.13	.76	2.42	.81	2.43	.95
PF/DS	2.07	.78	2.26	.86	2.50	.82
Supporting Arguments						
DF/PS	2.07	.68	2.31	.71	2.37	.97
PF/DS	1.93	.69	2.45	.72	2.37	.76
Conclusion Statements						
DF/PS	1.19	.48	2.08	1.02	2.20	1.08
PF/DS	1.43	.82	2.00	.93	2.20	1.00
Organization						
DF/PS	2.29	.78	2.52	.97	2.60	1.01
PF/DS	2.30	.65	2.84	.86	2.70	.79
Tone						
DF/PS	1.74	.63	2.19	.79	2.14	.77
PF/DS	1.73	.78	2.23	.72	2.17	.79
Spelling						
DF/PS	3.39	.62	3.44	.69	3.20	.41
PF/DS	3.37	.49	3.39	.56	3.50	.57
Grammar						
DF/PS	3.07	.44	3.06	.58	3.23	.43
PF/DS	3.10	.40	3.10	.40	3.17	.46
Overall Scores						
DF/PS	18.84	2.73	21.11	4.81	21.31	4.34
PF/DS	18.87	3.48	21.39	3.94	21.53	4.23

Notes. Pre-test Digital First/PS (n=31) and Paper First/DS (n=30), Post-test 1 Digital First/PS
(n=36) and Paper First/DS (n=31), and Post-test 2 Digital First/PS (n=35) and Post-test 2 Paper
First/DS (n=30)
n=mean
sd-standard deviation

Table 4

Descriptive Statistics of Pre-test Mean Scores by Classroom

Scale	Class 1 Woodson4 (N=9) Mean	SD	Class2 Woodson5 (N=15) Mean	SD	Class 3 Tillman (N=14) Mean	SD	Class 4 Northington (N=23) Mean	SD	Total (N=61) Overall	SD
Goal Statements	3.00	.00	2.93	.26	2.93	.27	2.96	.56	2.95	.38
Reasoning Statements	1.67^a	.71	2.53^b	.64	1.43^c	.51	2.39^b	.66	2.10	.77
Supporting Arguments	1.78	.67	2.20	.68	1.57^a	.65	2.22^b	.60	2.00	.68
Conclusion Statements	1.11	.33	1.53	.83	1.07	.27	1.39	.78	1.31	.67
Organization	1.56^b	.53	2.27	.80	2.71^d	.47	2.35^c	.65	2.30	.72
Tone	1.22^a	.44	2.13^b	.74	1.36^d	.50	1.91^b	.67	1.74	.70
Spelling	3.44	.53	3.53	.52	3.21	.43	3.35	.65	3.38	.55
Grammar	3.00	.00	3.13	.35	3.07	.27	3.09	.60	3.08	.42
Overall Scores	16.78^a	1.72	20.27^b	2.96	17.36^c	1.86	19.65	3.50	18.85	3.10

Note: Total participants in the current study (n=67). This chart depicts total number of study participants minus data that was not available due to six instances of absences during pre-testing.

Means with the following different superscripts: a/b, b/c, and d/b are significantly different from one other.

Table 5

Descriptive Statistics for pre- to post-test 1 scores of students that used Digital First/PS (n=31) and Paper First/DS (n=30) for Research

Question 1

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Goal Statements								
DF/PS	2.97	.18	3.23	.62	-2.50	30	.02*	1.44
PF/DS	2.93	.52	3.13	.43	-1.65	29	.11	.38
Reasoning Statements								
DF/PS	2.13	.76	2.52	.77	-2.34	30	.03*	.51
PF/DS	2.07	.78	2.27	.87	-.97	29	.34	.26
Supporting Arguments								
DF/PS	2.07	.68	2.42	.62	-2.62	30	.01*	.51
PF/DS	1.93	.69	2.47	.73	-3.00	29	.005*	.78
Conclusion Statements								
DF/PS	1.19	.48	2.19	1.01	-5.39	30	<0.001*	2.08
PF/DS	1.43	.82	2.00	.95	-2.81	29	.009*	.70
Overall Scores								
DF/PS	18.84	2.73	22.10	3.95	-5.56	30	<0.001*	1.19
PF/DS	18.87	3.48	21.40	4.01	-3.25	29	.003*	.73

Note. Digital First/PS (DF/PS) – Digital Graphic Organizer used first/Paper-based Graphic Organizer used second. Paper First/DS (PF/DS) – Paper-based Graphic Organizer used first/Digital Graphic Organizer used second.
*significant p < 0.05
t=test statistic
df=degrees of freedom
Glass' delta refers to effect size

Pre-test to Post-test 1 Results for Students Aged 8-9 and 10-11.

There were significant changes in two areas (as noted in Table 6) from pre- to post-test 1 scores of students aged 8-9 who used digital graphic organizers first at post-test 1 for the following outcomes: conclusion statements and overall scores, with large effect sizes.   However, when using paper-based graphic organizers first, there were no significant changes for students ages 8-9.

Inspection of the table for students aged 10-11 who used digital graphic organizers first reveals significant changes in all five areas (as noted in Table 6): goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores with medium to large effect sizes. When using paper-based graphic organizers first, there were also significant changes in five areas: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores with large effect sizes. These results indicate that there are differences based on age of subjects with the older students benefiting from the use of both digital and paper-based graphic organizers, as compared to younger students.

Table 6

Descriptive Statistics for pre- to post-test 1 scores of students ages 8-9 that used Digital First/PS (n=13) and Paper First/DS (n=17), and

ages 10-11 that used Digital First/PS (n=17) and Paper First/DS (n=13) for Research Question 1

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Ages 8-9								
Goal Statements								
DF/PS	3.00	.00	3.15	.69	-.81	12	.44	n/a
PF/DS	3.12	.33	3.00	.35	1.00	16	.33	.36
Ages 10-11								
Goal Statements								
DF/PS	2.94	.24	3.29	.59	-2.95	16	.01*	1.46
PF/DS	2.69	.63	3.31	.48	-3.41	12	.01*	.98
Ages 8-9								
Reasoning Statements								
DF/PS	2.00	.58	2.23	.93	-.76	12	.46	.40
PF/DS	2.35	.70	2.06	.83	1.23	16	.24	-.41
Ages 10-11								
Reasoning Statements								
DF/PS	2.18	.88	2.71	.59	-2.73	16	.02*	.60
PF/DS	1.69	.75	2.54	.88	-3.09	12	.01*	1.13
Ages 8-9								
Supporting Arguments								
DF/PS	1.92	.64	2.23	.44	-1.48	12	.17	.48
PF/DS	2.18	.64	2.41	.62	-1.07	16	.30	.36

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Ages 10-11								
Supporting Arguments								
DF/PS	2.12	.70	2.59	.71	-2.70	16	.02*	.67
PF/DS	1.62	.65	2.54	.88	-3.49	12	.004*	1.42
Ages 8-9								
Conclusion Statements								
DF/PS	1.08	.28	2.00	.91	-3.86	12	.002*	3.29
PF/DS	1.53	.87	1.82	.88	-1.10	16	.29	.33
Ages 10-11								
Conclusion Statements								
DF/PS	1.29	.59	2.41	1.06	-3.95	16	.001*	1.90
PF/DS	1.31	.75	2.23	1.01	-3.21	12	.01*	1.23
Ages 8-9								
Overall Scores								
DF/PS	18.69	2.39	21.23	3.32	-2.79	12	.02*	1.06
PF/DS	19.65	3.24	20.41	3.62	-.77	16	.46	.23
Ages 10-11								
Overall Scores								
DF/PS	18.82	3.07	22.77	4.47	-4.97	16	<.001*	1.29
PF/DS	17.85	3.65	22.69	4.25	-5.24	12	<.001*	1.33

Note: n/a= no variance in the outcome on the pre-test for that group and so effect size was not reported.
*significant $p < 0.05$

Pre-test to Post-test 1 Results for Females and Males. In reviewing pre-test data of females and males, it appears that although all participants were stratified, within classes, when analyzed by gender it appears that the male and female groups were not equivalent with females showing increased mean scores. Upon data analysis, there were significant changes, for females, in five areas (as noted in Table 7) when using digital graphic organizers first for pre- to post-test 1 scores for the following outcomes: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores with large effect sizes. When using paper-based graphic organizers first, for females, there was a significant change for supporting arguments and overall scores with large effect sizes. When reviewing the data for males using digital graphic organizers first there were significant changes for two areas: conclusion statements and overall scores, with small to large effect sizes. When using paper-based graphic organizers, for males, there were no significant changes. These results indicate that there are differences based on the gender of subjects in the current study with female students revealing advantages of using paper-based graphic organizers first (two outcomes) and digital graphic organizers first (five outcomes) as compared to male students.

Table 7

Descriptive Statistics for pre- to post-test 1 scores of females (n=17) that used Digital First/PS and Paper First/DS (n=17) and males that used Digital First/PS (n=13) and Paper First/DS (n=13) for Research Question One

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Female								
Goal Statements								
DF/PS	3.00	.000	3.35	.61	-2.40	16	.03*	n/a
PF/DS	3.00	.000	3.18	.53	-1.38	16	.19	n/a
Male								
Goal Statements								
DF/PS	2.92	.28	3.08	.64	-1.00	12	.34	.57
PF/DS	2.85	.80	3.08	.28	-1.00	12	.34	.29
Female								
Reasoning Statements								
DF/PS	2.24	.75	2.82	.73	-2.42	16	.03*	.77
PF/DS	1.94	.66	2.35	.93	-1.44	16	.17	.62
Male								
Reasoning Statements								
DF/PS	1.92	.76	2.08	.64	-.69	12	.50	.21
PF/DS	2.23	.93	2.15	.80	.27	12	.79	-.09
Female								
Supporting Arguments								
DF/PS	2.24	.66	2.77	.56	-2.73	16	.02*	.80
PF/DS	1.82	.64	2.53	.72	-2.78	16	.01*	1.11
Male								
Supporting Arguments								
DF/PS	1.77	.60	2.00	.41	-1.39	12	.19	.38
PF/DS	2.08	.76	2.39	.77	-1.30	12	.22	.41

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Female								
Conclusion Statements								
DF/PS	1.29	.59	2.65	1.00	-5.00	16	<0.001*	2.31
PF/DS	1.41	.87	2.00	.87	-1.90	16	.08	.68
Male								
Conclusion Statements								
DF/PS	1.08	.28	1.69	.75	-2.89	12	.01*	2.18
PF/DS	1.46	.78	2.00	1.08	-2.21	12	.05	.69
Female								
Overall Scores								
DF/PS	19.82	2.38	24.00	4.14	-4.84	16	<0.001*	1.76
PF/DS	18.29	3.06	21.77	4.24	-3.09	16	.007	1.14
Male								
Overall Scores								
DF/PS	17.39	2.66	19.62	2.10	-3.03	12	.01*	.84
PF/DS	19.62	3.97	20.92	3.80	-1.34	12	.21	.33

Note: n/a= no variance in the outcome on the pre-test for that group and so effect size was not reported.
*significant p < 0.05

Pre-test to Post-test 2 Results

There were significant changes in three areas (as noted in Table 8) from

pre- to post-test 2 scores for the following outcomes: supporting arguments,

conclusion statements, and overall scores, in both groups, with medium to large

effect sizes.

When analyzing the group that had recent digital use/prior paper use

(RDU/PPU) for post-test 2, there were significant changes across three areas

(supporting arguments, conclusion statements, and the overall scores) with effect

sizes ranging from medium to large. For recent paper use/prior digital use

(RPU/PDU) for post-test 2, significant changes were revealed for the following

four areas: reasoning statements, supporting arguments, conclusion statements,

and overall scores, with medium to large effect sizes. The results indicate that

both paper-based and digital graphic organizers continue to lead to significant

improvements in persuasive writing.

Pre-test to Post-test 2 Results for Students Aged 8-9 and 10-11.

There were significant changes in two areas (as noted in Table 9) from pre- to

post-test 2 scores for students aged 8-9 that had recent paper organizer use,

prior digital use (RPU/PDU), for the conclusion statements and overall scores

with large effect sizes. When exposed to recent digital use/prior paper use

(RDU/PPU), there were no significant changes for students aged 8-9. Inspection

of the table reveals at ages 10-11, students with recent paper use/prior digital

use had significant changes in two areas (conclusion statements and overall

scores) with large effect sizes. When recently using digital graphic

organizers/prior paper-based graphic organizer use, there were significant changes, for students aged 10-11, in four areas (reasoning statements, supporting arguments, conclusion statements, and overall scores) with large effect sizes. These results indicate that there are differences based on the age of subjects with older students resulting in greater improvements when they recently used a digital graphic organizer, after prior exposure to a paper-based graphic organizer.

Table 8

Descriptive Statistics for pre- to post-test 2 scores of students with Recent Paper Use/Prior Digital Use (n=30) and Recent Digital

Use/Prior Paper Use (n=30) for Research Question One

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Goal Statements								
RPU/PDU	2.93	.52	2.97	.67	-.20	29	.85	.08
RDU/PPU	2.97	.18	3.13	.51	-1.72	29	.10	.89
Reasoning Statements								
RPU/PDU	2.10	.80	2.53	.82	-2.54	29	.02*	.54
RDU/PPU	2.10	.76	2.40	1.00	-1.27	29	.21	.39
Supporting Arguments								
RPU/PDU	1.97	.72	2.40	.77	-3.07	29	.01*	.60
RDU/PPU	2.03	.67	2.43	.97	-2.11	29	.04*	.60
Conclusion Statements								
RPU/PDU	1.43	.82	2.17	.99	-4.25	29	<0.001*	.90
RDU/PPU	1.20	.48	2.37	1.07	-6.73	29	<0.001*	2.44
Overall Scores								
RPU/PDU	18.90	3.50	21.57	4.24	-3.83	29	<0.001*	.76
RDU/PPU	18.77	2.75	21.63	4.51	-4.15	29	<0.001*	1.04

Note: Recent Paper use/Prior Digital use (RPU/PDU) – Recently used a Paper-based Graphic Organizer after prior digital use, Recent Digital use/Prior Paper use (RDU/PPU) – Recently used a Digital Graphic Organizer after prior paper-based graphic organizer use.

*significant p < 0.05

Table 9

Descriptive Statistics for pre-to post-test 2 scores of students aged 8-9 and 10-11 with Recent Paper Use /Prior Digital Use and those with

Recent Digital Use/Prior Paper Use for Research Question One

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 8-9								
Goal Statements								
RPU/PDU	3.00	.00	3.08	.49	-.56	12	.58	n/a
RDU/PPU	3.12	.33	2.88	.60	1.46	16	.16	-.73
Ages 10-11								
Goal Statements								
RPU/PDU	2.94	.24	3.18	.53	-1.73	16	.10	1.00
RDU/PPU	2.67	.65	3.08	.79	-1.24	11	.24	.63
Ages 8-9								
Reasoning Statements								
RPU/PDU	2.00	.58	2.15	.80	-.52	12	.61	.26
RDU/PPU	2.35	.70	2.47	.62	-.57	16	.58	.17
Ages 10-11								
Reasoning Statements								
RPU/PDU	2.18	.88	2.59	1.12	-1.16	16	.26	.47
RDU/PPU	1.67	.78	2.58	1.08	-3.53	11	.005*	1.17
Ages 8-9								
Supporting Arguments								
RPU/PDU	1.92	.64	2.23	.83	-1.00	12	.34	.48
RDU/PPU	2.18	.64	2.29	.69	-.62	16	.54	.17
Ages 10-11								
Supporting Arguments								
RPU/PDU	2.12	.70	2.59	1.06	-1.93	16	.07	.67
RDU/PPU	1.58	.67	2.50	.90	-6.17	11	<0.001*	1.37

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 8-9								
Conclusion Statements								
RPU/PDU	1.08	.28	2.08	.95	-4.42	12	.001*	3.57
RDU/PPU	1.53	.87	2.06	1.03	-2.17	16	.05	.61
Ages 10-11								
Conclusion Statements								
RPU/PDU	1.29	.59	2.59	1.12	-5.10	16	<0.001*	2.20
RDU/PPU	1.33	.78	2.33	.98	-4.06	11	.002*	1.28
Ages 8-9								
Overall Scores								
RPU/PDU	18.69	2.39	20.85	3.41	-2.33	12	.04*	.90
RDU/PPU	19.65	3.24	21.06	4.26	-1.61	16	.13	.44
Ages 10-11								
Overall Scores								
RPU/PDU	18.82	3.07	22.24	5.23	-3.42	16	.003*	1.11
RDU/PPU	17.67	3.75	22.17	4.47	-4.26	11	.001*	1.20

Note: n/a= no variance in the outcome on the pre-test for that group and so significance testing was not reported.
Students ages 8-9 - Recent Paper Use/Prior Digital Use (RPU/PDU) (n=13) and Recent Digital Use/Prior Paper Use (n=17);
Students ages 10-11 - Recent Paper Use/Prior Digital Use (n=17) and Recent Digital Use/Prior Paper Use (n=12)
*significant p < 0.05

Pre-test to Post-test 2 Results for Females and Males. There was a significant change in only one area (as noted in Table 10) from pre- to post-test 2 scores of females, when recently using a paper-based graphic organizer/prior digital graphic organizer use, for the conclusion statements with a large effect size. When exposed to the recent use of a digital graphic organizer/prior paper-based graphic organizer use, for females, there was a significant change in the following four areas: reasoning statements, supporting arguments, conclusion statements, and overall scores with large effect sizes. When analyzing data for male students with recent paper-based use/prior digital graphic organizer use, there were significant changes in the following three areas: goal statements, conclusion statements, and overall scores with large effect sizes. When there was recent digital use/prior paper-based graphic organizer use, for males, there was a significant change in one area: conclusion statements with a large effect size. These results indicate that differences exist with regard to gender, resulting in greater advantages of female students recently using a digital graphic organizer with previous exposure to a paper-based graphic organizer. In addition results for males are reversed, with males showing a greater advantage of recently using a paper-based graphic organizer after prior digital use.

Table 10

Descriptive Statistics for pre- to post-test 2 scores of females with Recent Paper Use/Prior Digital Use (n=17) and Recent Digital Use/Prior Paper Use (n=16) and males with Recent Paper Use/Prior Digital Use (n=13) and Recent Digital Use/Prior Paper Use (n=13) for Research Question One

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Female								
Goal Statements								
RPU/PDU	3.00	.000	3.06	.56	-.44	16	.67	n/a
RDU/PPU	3.00	.000	2.88	.89	.57	15	.58	n/a
Male								
Goal Statements								
RPU/PDU	2.92	.28	3.23	.44	-2.31	12	.04*	1.11
RDU/PPU	2.85	.80	3.08	.28	-.82	12	.43	.29
Female								
Reasoning Statements								
RPU/PDU	2.24	.75	2.59	.94	-1.19	16	.25	.47
RDU/PPU	1.94	.68	2.69	.87	-3.50	15	.003*	1.10
Male								
Reasoning Statements								
RPU/PDU	1.92	.76	2.15	1.07	-.59	12	.57	.30
RDU/PPU	2.23	.93	2.31	.75	-.29	12	.78	0.09
Female								
Supporting Arguments								
RPU/PDU	2.24	.66	2.71	.92	-1.93	16	.07	.71
RDU/PPU	1.81	.66	2.56	.81	-4.39	15	.001*	1.14
Male								
Supporting Arguments								
RPU/PDU	1.77	.60	2.08	.95	-1.00	12	.34	.52
RDU/PPU	2.08	.76	2.15	.69	-.37	12	.72	.09

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Female								
Conclusion Statements								
RPU/PDU	1.29	.59	2.71	1.05	-6.69	16	<0.001*	2.41
RDU/PPU	1.44	.89	2.19	1.05	-2.82	15	.01*	.84
Male								
Conclusion Statements								
RPU/PDU	1.08	.28	1.92	.95	-3.09	12	.009*	3.00
RDU/PPU	1.46	.78	2.15	.99	-2.92	12	.01*	.88
Female								
Overall Scores								
RPU/PDU	19.82	2.38	22.71	4.61	-3.06	16	.008	1.21
RDU/PPU	18.19	3.12	21.94	5.17	-3.61	15	.003*	1.20
Male								
Overall Scores								
RPU/PDU	17.39	2.66	20.23	4.15	-2.70	12	.02*	1.07
RDU/PPU	19.62	3.97	21.00	3.06	-1.56	12	.15	.35

Note. n/a= no variance in the outcome on the pre-test for that group and so significance testing was not reported.
*significant p < 0.05

Post-test 1 to Post-test 2 Results

There were no significant changes for any of the five outcomes (as noted in Table 11) from post-test 1 to post-test 2 scores for the following outcomes: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores, in both groups, which include students with recent paper use/prior digital use and those with recent digital use/prior paper use.

Both groups (RPU/PDU and RDU/PPU) showed no significant differences on post-test 1 to post-test 2, regardless of 1) the type of graphic organizer used, 2) the sequence of use of the graphic organizers, 3) the age of the students (aged 8-9 or 10-11), and 4) the gender of the students (female or male).

Post-test 1 to Post-test 2 Results for Ages 8-9 and 10-11. There were no significant changes (as noted in Table 12) from post-test 1 to post-test 2 scores for students aged 8-9 and 10-11.

Post-test 1 to Post-test 2 Results for Females and Males. There were no significant changes (as noted in Table 13) from post-test 1 to post-test 2 scores, in both groups.

Table 11

Descriptive Statistics for post-test 1 to post-test 2 scores of students that used Digital First & Recent Paper Use/PDU (n=35) and Paper

First & Recent Digital Use/PPU (n=30) for Research Question One

Scale	M Post-test 1	SD	M Post-test 2	SD	t	df	p	Glass' delta
Goal Statements								
DF & Recent Paper Use/PDU	3.11	.72	3.14	.49	-.22	34	.83	.04
PF & Recent Digital Use/PPU	3.13	.43	2.93	.69	1.19	29	.25	-.47
Reasoning Statement								
DF & Recent Paper Use/PDU	2.46	.78	2.43	.95	.16	34	.88	-.04
PF & Recent Digital Use/PPU	2.27	.87	2.50	.82	-1.19	29	.24	.26
Supporting Arguments								
DF & Recent Paper Use/PDU	2.34	.68	2.37	.97	-.19	34	.85	.04
PF & Recent Digital Use/PPU	2.47	.73	2.37	.76	.62	29	.54	-.14
Conclusion Statements								
DF & Recent Paper Use/PDU	2.11	1.02	2.20	1.08	-.53	34	.60	.09
PF & Recent Digital Use/PPU	2.00	.95	2.20	1.00	-.97	29	.34	.21
Overall Scores								
DF & Recent Paper Use/PDU	21.31	4.72	21.31	4.34	.00	34	1.00	.00
PF & Recent Digital Use/PPU	21.43	4.00	21.53	4.23	-.13	29	.90	.03

Note. DF & Recent Paper Use/PDU = Digital First at Post-test 1 and Recent Paper Use after Prior Digital Use at Post-test 2.
PF & Recent Digital Use/PPU = Paper First at Post-test 1 and Recent Digital Use after Prior Paper Use at Post-test 2.
*significant p < 0.05

Table 12

Descriptive Statistics for post-test 1 to post-test 2 scores of students aged 8-9 that used Digital First & Recent Paper Use/PDU (n=15) and Paper First & Recent Digital Use/PPU (n=18) and scores of students aged 10-11 that used Digital First & Recent Paper Use/PDU (n-19) and Paper First & Recent Digital Use/PPU (n=12) for Research Question One

Scale	M Post-test 1	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 8-9								
Goal Statements								
DF & Recent Paper Use/PDU	3.07	.70	3.07	.46	.00	14	1.00	.00
PF & Recent Digital Use/PPU	3.00	.34	2.83	.62	.90	17	.38	-.50
Ages 10-11								
Goal Statements								
DF & Recent Paper Use/PDU	3.16	.76	3.21	.54	-.29	18	.77	0.07
PF & Recent Digital Use/PPU	3.33	.49	3.08	.79	.76	11	.46	-.51
Ages 8-9								
Reasoning Statements								
DF & Recent Paper Use/PDU	2.27	.88	2.27	.80	.00	14	1.00	.00
PF & Recent Digital Use/PPU	2.06	.80	2.44	.62	-1.80	17	.09	.48
Ages 10-11								
Reasoning Statement								
DF & Recent Paper Use/PDU	2.58	.69	2.53	1.07	.24	18	.82	-.07
PF & Recent Digital Use/PPU	2.58	.90	2.58	1.08	.00	11	1.00	.00

Scale	M Post-test 1	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 8-9								
Supporting Arguments								
DF & Recent Paper Use/PDU	2.20	.56	2.27	.80	-.25	14	.81	.13
PF & Recent Digital Use/PPU	2.39	.61	2.28	.67	.52	17	.61	-.18
Ages 10-11								
Supporting Arguments								
DF & Recent Paper Use/PDU	2.47	.77	2.42	1.12	.29	18	.77	-.06
PF & Recent Digital Use/PPU	2.58	.90	2.50	.90	.32	11	.75	-.09
Ages 8-9								
Conclusion Statements								
DF & Recent Paper Use/PDU	2.00	.93	1.93	.96	.25	14	.81	-.08
PF & Recent Digital Use/PPU	1.83	.86	2.11	1.02	-1.2	17	.24	.33
Ages 10-11								
Conclusion Statements								
DF & Recent Paper Use/PDU	2.26	1.10	2.42	1.17	-.77	18	.45	.15
PF & Recent Digital Use/PPU	2.25	1.06	2.33	.98	-.21	11	.84	.08
Ages 8-9								
Overall Scores								
DF & Recent Paper Use/PDU	20.67	3.90	20.60	3.25	.08	14	.94	-.02
PF & Recent Digital Use/PPU	20.44	3.52	21.11	4.14	-.71	17	.49	.19
Ages 10-11								
Overall Scores								
DF & Recent Paper Use/PDU	21.79	5.44	21.79	5.15	.00	18	1.00	0.00
PF & Recent Digital Use/PPU	22.92	4.36	22.17	4.47	.52	11	.61	-0.17

Note. *significant p< 0.05

Table 13

Descriptive Statistics for post-test 1 to post-test 2 scores of females that used Digital First & Recent Paper Use/PDU (n=17) and Paper

First & Recent Digital Use/PPU (n=16) and male students that used Digital First & Recent Paper Use/PDU (n=17) and Paper First &

Recent Digital Use/PPU (n=14) for Research Question One

Scale	M Post-test 1	SD	M Post-test 2	SD	t	df	p	Glass' delta
Female Goal Statements								
DF & Recent Paper Use/PDU	3.35	.61	3.06	.56	1.57	16	.14	-.48
PF & Recent Digital Use/PPU	3.19	.54	2.88	.89	1.05	15	.31	-.57
Male Goal Statements								
DF & Recent Paper Use/PDU	2.88	.78	3.24	.44	-2.07	16	.06	.46
PF & Recent Digital Use/PPU	3.07	.27	3.00	.39	.56	13	.58	-.26
Female Reasoning Statements								
DF & Recent Paper Use/PDU	2.82	.73	2.59	.94	.89	16	.39	-.32
PF & Recent Digital Use/PPU	2.38	.96	2.69	.87	-1.10	15	.29	.32
Male Reasoning Statements								
DF & Recent Paper Use/PDU	2.06	.66	2.24	.97	-.68	16	.51	.27
PF & Recent Digital Use/PPU	2.14	.77	2.29	.73	-.52	13	.61	.19
Female Supporting Arguments								
DF & Recent Paper Use/PDU	2.77	.56	2.71	.92	.29	16	.77	-.11
PF & Recent Digital Use/PPU	2.56	.73	2.56	.81	.00	15	1.00	.00

Scale	M Post-test 1	SD	M Post-test 2	SD	t	df	p	Glass' delta
Male								
Supporting Arguments								
DF & Recent Paper Use/PDU	1.94	.56	2.00	.94	-.25	16	.81	.11
PF & Recent Digital Use/PPU	2.36	.75	2.14	.66	1.00	13	.34	-.29
Female								
Conclusion Statements								
DF & Recent Paper Use/PDU	2.65	1.00	2.71	1.05	-.32	16	.75	.06
PF & Recent Digital Use/PPU	2.00	.89	2.19	1.05	-.59	15	.57	.21
Male								
Conclusion Statements								
DF & Recent Paper Use/PDU	1.65	.79	1.71	.92	-.21	16	.84	.08
PF & Recent Digital Use/PPU	2.00	1.04	2.21	.98	-.82	13	.43	.20
Female								
Overall Scores								
DF & Recent Paper Use/PDU	24.00	4.14	22.71	4.61	1.60	16	.13	-.31
PF & Recent Digital Use/PPU	21.88	4.35	21.94	5.17	-.05	15	.96	.01
Male								
Overall Scores								
DF & Recent Paper Use/PDU	18.59	3.83	19.82	3.76	-1.36	16	.19	.32
PF & Recent Digital Use/PPU	20.93	3.65	21.07	2.95	-.18	13	.86	.04

Note: *significant p < 0.05

Persuasive Writing Process Mechanic Items: Research Question Two

Research Question Two: Post-test Findings

For research question two, the pre-test mean scores for the digital first/paper second and paper first/digital second groups (as noted in Table 14), for all variables, are similar. This represents the stratification of students at the outset of study to ensure the groups were equivalent and functioning at the same level of ability. As with research question one, this ensured that any differences recognized at post-tests were not a result of initial ability levels but actual performance caused by the treatments.

There were no differences in writing performance at post-test 1 (as noted in Table 14), between students who had used digital graphic organizers and students who used paper-based graphic organizers for the following four variables: organization, tone, spelling, and grammar. At post-test 2, there was one significant difference in the area of spelling with a medium effect size for students that used digital graphic organizers.

The data suggest that, at post-test 1, the type of graphic organizer does not cause any overall differences in the writing performance specific to the organization, tone, spelling, and grammar. However, at post-test two, there is one significant difference, in spelling, when recently using a digital graphic organizer after prior paper-based graphic organizer use with a medium effect size based on Hedge's g.

Table 14

Table of Means, Standard Deviations, Independent t-tests, and Effect Sizes for Group Comparisons of Pre-test Digital First/PS (n=31) vs.

Paper First/DS (n=30) Group Comparisons, Post-test 1 Digital First/PS (n=36) vs. Paper First/DS (n=31) Group Comparisons, and

Post-test 2 Recent Paper Use/PDU (n=35) vs. Recent Digital Use/PPU (n=30) Group Comparisons for Research Question Two

Scale	Digital First/PS		Paper First/DS						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Pre-test									
Organization	2.29	.78	2.30	.65	-.01	-.05	59	.96	-.01
Tone	1.74	.63	1.73	.78	.01	.05	59	.96	.01
Spelling	3.39	.62	3.37	.49	.02	.14	59	.89	.04
Grammar	3.07	.44	3.10	.40	.04	-.33	59	.75	-.07
Post-test 1									
Organization	2.53	.97	2.84	.86	-.31	-1.38	65	.17	-.33
Tone	2.19	.79	2.23	.72	-.03	-.17	65	.87	-.05
Spelling	3.44	.69	3.39	.56	.06	.37	65	.71	.08
Grammar	3.06	.58	3.10	.40	-.04	-.33	65	.74	-.08
	Recent Paper Use/PDU		Recent Digital Use/PPU						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Post-test 2									
Organization	2.60	1.01	2.70	.79	-.10	-.44	63	.66	-.11
Tone	2.14	.77	2.17	.79	-.02	-.12	63	.90	-.04
Spelling	3.20	.41	3.50	.57	-.30	-2.46	63	.02*	-.60
Grammar	3.23	.43	3.17	.46	.06	.56	63	.58	.13

*significant p < 0.05; Hedges' g refers to effect size.

Post-test Results for students aged 8-9 and 10-11. For research question two, on post-test 1, there were no differences in writing performance (as noted in Table 15) between students aged 8-9 and 10-11 who used digital and paper-based graphic organizers for the following four variables: organization, tone, spelling, and grammar.

At post-test 2, there were no differences in the four areas in writing performance for students aged 8-9 (as noted in Table 15) that used digital graphic organizers and students who used paper-based graphic organizers for organization, tone, spelling, and grammar. For students aged 10-11, there were no differences in the following three areas: organization, tone, and grammar. However, there was one significant difference in spelling for students aged 10-11 at post-test 2, with a large effect size, for the group that used paper-based graphic organizers for post-test 2.

Overall, the type of graphic organizer did not produce any differences in the writing performance specific to organization, tone, spelling, and grammar with the exception of the one incident at post-test 2 for spelling when students aged 10-11 used a paper-based graphic organizer.

Post-test Results for females and males. For Research Question Two, there were no differences at post-test 1, (as noted in Table 16) in writing performances between female students who used digital graphic organizers and those who used paper-based organizers for the following four variables: organization, tone, spelling, and grammar. For male students, there was a significant difference in one area: organization, with a large effect size, when using a digital graphic organizer at post-test 1. However, there were no differences for tone, spelling, and grammar for males. At

post-test 2, when using a digital graphic organizer there was a significant difference in spelling for female students with a large effect size. There were no significant differences, for females, in organization, tone, and grammar. Across all four areas no significant differences were evident at post-test 2 for male students.

In examining pre-test data, male students in both organizer groups had no significant differences based on initial mean scores. Based on mean scores, male students who received a paper-based graphic organizer first performed at higher levels than males who received a digital graphic organizer first. In examining pre-test data based on initial mean scores, females assigned to the digital first group were performing better in the following areas: tone, spelling, and grammar, than female students in the paper-based graphic organizer first group with a significant difference in the area of grammar.

Based on initial mean scores, when examining differences by gender, at the pre-test stage it appears that females assigned to the digital first group were performing better than male students in the area of tone, spelling, and grammar. Whereas males assigned to the paper first group were performing better than females in the area of organization, tone, spelling, and grammar at the outset of the study. Although these differences exist, by gender, students were stratified, within the current study, by ability levels within their respective classrooms.

Table 15

Table of Means, SD, independent t-test results, and effect sizes for pre-test Digital First/PS (n=13) vs. Paper First/DS (n=17) group, post-test 1 Digital First/PS (n=16) vs. Paper First/DS (n=18) group, post-test 2 Recent Paper Use/PDU (n=15) vs. Recent Digital Use/PPU (n=18) group comparisons for students aged 8-9, pre-test Digital First/PS (n=18) vs. Paper First/DS (n=13) group, post-test 1 Digital First/PS (n=20) vs. Paper First/DS (n=13) group, post-test 2 Recent Paper Use/PDU (n=20) vs Recent Digital Use/PPU (n=12) group for students aged 10-11 for Research Question Two

Scale	Digital First/PS		Paper First/DS						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Pre-test									
Organization									
Ages 8-9	2.54	.66	2.29	.59	.24	1.07	28	.29	.39
Ages 10-11	2.11	.83	2.31	.75	-.20	-.68	29	.51	-.25
Tone									
Ages 8-9	1.69	.63	1.82	.73	-.13	-.52	28	.61	-.18
Ages 10-11	1.78	.65	1.62	.87	.16	.60	29	.56	.20
Spelling									
Ages 8-9	3.39	.65	3.24	.44	.15	.75	28	.46	.27
Ages 10-11	3.39	.61	3.54	.52	-.15	-.72	29	.48	-.26
Grammar									
Ages 8-9	3.08	.49	3.12	.33	-.04	-.27	28	.79	-.10
Ages 10-11	3.06	.42	3.08	.49	-.02	-.13	29	.90	-.04
Post-test 1									
Organization									
Ages 8-9	2.56	.73	2.67	.77	-.10	-.41	32	.69	-.14
Ages 10-11	2.50	1.15	3.08	.95	-.58	-1.50	31	.14	-.53

Scale	Digital First/PS Mean	SD	Paper First/DS Mean	SD	MD	t	df	p	Hedges' g
Tone									
Ages 8-9	2.06	.77	2.11	.76	-.05	-.19	32	.85	-.06
Ages 10-11	2.30	.80	2.39	.65	-.08	-.32	31	.75	-.12
Spelling									
Ages 8-9	3.31	.60	3.33	.59	-.02	-.10	32	.92	-.03
Ages 10-11	3.55	.76	3.46	.52	.09	.37	31	.72	.13
Grammar									
Ages 8-9	3.06	.44	3.06	.42	.01	.05	32	.96	.00
Ages 10-11	3.05	.69	3.15	.38	-.10	-.50	31	.62	-.17

	Recent Paper Use/PDU		Recent Digital Use/PPU						
Post test 2									
Organization									
Ages 8-9	2.60	.91	2.67	.84	-.07	-.22	31	.83	-.08
Ages 10-11	2.60	1.10	2.75	.75	-.15	-.42	30	.68	-.15
Tone									
Ages 8-9	2.07	.80	2.22	.65	-.16	-.62	31	.54	-.20
Ages 10-11	2.20	.77	2.08	1.00	.12	.37	30	.71	.14
Spelling									
Ages 8-9	3.20	.41	3.44	62	-.24	-1.31	31	.20	-.44
Ages 10-11	3.20	.41	3.59	.51	-.38	-2.33	30	.03*	-.85
Grammar									
Ages 8-9	3.20	.41	3.11	.47	.09	.57	31	.57	.20
Ages 10-11	3.25	.44	3.25	.45	.00	.00	30	1.00	.00

Note. *significant p < 0.05

Table 16

Table of Means, SD, independent t-test results, and effect sizes for group comparisons of females pre-test Digital First/PS(n=17) vs.

Paper First/DS (n=17), post-test 1 Digital First/PS (n=18) vs. Paper First/DS (n=17), post-test 2 Recent Paper Use/PDU (n-17) vs. Recent

Digital Use/PPU (n=16), group comparisons of males pre-test Digital First/PS (n=14) vs. Paper First/DS (n=13), post-test 1 Digital First/PS

(n=18) vs. Paper First/DS (n=14), post-test 2 Recent Paper Use/PDU (n=18) vs. Recent Digital Use/PPU (n=14) group for Research

Question Two.

Scale	Digital First/PS		Paper First/DS						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Pre-test									
Organization									
Female	2.29	.77	2.29	.69	.00	.000	32	1.00	.00
Male	2.29	.83	2.31	.63	-.02	-.08	25	.94	-.03
Tone									
Female	2.00	.61	1.59	.80	.41	1.69	32	.10	.56
Male	1.43	.51	1.92	.76	-.49	-2.00	25	.06	-.73
Spelling									
Female	3.53	.51	3.24	.44	.29	1.80	32	.08	.60
Male	3.21	.70	3.54	.52	-.32	-1.36	25	.19	-.52
Grammar									
Female	3.24	.44	3.00	.000	.03	2.22	32	.03*	.75
Male	2.86	.36	3.23	.60	.37	-1.98	25	.06	-.73
Post-test 1									
Organization									
Female	2.89	.90	2.82	.95	07	.21	33	.84	.07
Male	2.17	.92	2.86	.77	-.69	-2.25	30	.03*	-.78

Scale	Digital First/PS		Paper First/DS		MD	t	df	p	Hedges' g
	Mean	SD	Mean	SD					
Tone									
Female	2.44	.92	2.35	.70	.41	.33	33	.74	.11
Male	1.94	.54	2.07	.73	-.13	-.57	30	.58	-.20
Spelling									
Female	3.61	.50	3.35	.61	.29	1.38	33	.18	.46
Male	3.28	.83	3.43	.51	-.15	-.60	30	.56	-.21
Grammar									
Female	3.28	.46	3.18	.53	.23	.61	33	.55	.20
Male	2.83	.62	3.00	.00	-.17	-1.01	30	.32	-.36

Scale	Recent Paper Use/PDU		Recent Digital Use/PPU		MD	t	df	p	Hedges' g
Post-test 2									
Organization									
Female	2.77	1.09	2.69	.95	.08	.22	31	.83	.08
Male	2.44	.92	2.71	.61	-.27	-.94	30	.35	-.33
Tone									
Female	2.35	.79	2.25	.93	.10	.34	31	.73	.11
Male	1.94	.73	2.07	.62	-.13	-.52	30	.60	-.19
Spelling									
Female	3.12	.33	3.50	.63	-.38	-2.19	31	.04*	-.74
Male	3.28	.46	3.50	.52	-.22	-1.28	30	.21	-.44
Grammar									
Female	3.41	.51	3.19	.54	.22	1.23	31	.23	.41
Male	3.06	.24	3.14	.36	-.09	-.82	30	.42	-.26

Note. *significant p < 0.05

Qualitative Findings - Student Perceptions

The survey data suggests that while students identified attributes that they liked and disliked about each type of organizer, there was a difference in student perceptions toward the writing assignment when using digital graphic organizers as compared to paper-based graphic organizers. Based on the interview data, 22 of 23 students (96%) indicated a preference of using digital graphic organizers over paper-based graphic organizers.

Paper-based Graphic Organizers – Disadvantages and Advantages

When sharing perceptions about their use of a paper-based graphic organizer, multiple students (more than one student with similar responses) indicated the following ways (as noted in Table 17) in which the paper-based graphic organizers assisted them: organization, easy to modify, no printer was required, spellcheck was not a distraction, the paper looked original, and they didn't have to worry about technical issues. However, multiple students also indicated that paper was a hindrance (Table 17) because they had limited space to write their responses, handwriting was required, lack of ability to manipulate the organizer boxes and text, it took longer to develop an organizer, and the process of manually erasing was an issue, as compared to using the delete button in the digital graphic organizer software.

Digital Graphic Organizers: Disadvantages and Advantages

When sharing perceptions about their use of the digital graphic organizer (as noted in Table 17), multiple students indicated that it assisted with the overall organization of the persuasive writing essay. Furthermore, they enjoyed the

digital text over handwriting, indicated that the digital graphic organizer was easy to manipulate, they had adequate space to write due to the box expansion, spellcheck was helpful, they were able to insert pictures, graphic organizers were visually appealing, and it was quicker to develop. However, multiple students indicated that using the digital graphic organizer (as noted in Table 17) was a hindrance because they had to worry about technical issues such as text deletion and alignment, developing the organizer was difficult for those not fluent in typing, at times they were unable to locate specific pictures they wanted to use in the digital software library, and spellcheck was a distraction.

When examining responses (as noted in Table 17), students provided a larger number of responses (n=34) when sharing perceptions about ways in which the use of a digital graphic organizer assisted them, as compared to responses (n=14) related to the use of a paper-based graphic organizer. When examining responses of how specific types of organizers served as a hindrance to students, there were more responses connected to the use of paper-based graphic organizers (n=17), as compared to the digital graphic organizers (n=14). Findings from student interviews about experiences using both types of graphic organizers indicate that when given a choice between the two for future use, 96% of the students interviewed indicated a preference of using a digital graphic organizer over a paper-based graphic organizer.

Table 17

Frequency of Qualitative Data based how Paper and Digital graphic organizers helped and

hindered students (n=23) with the persuasive writing assignment

	Frequency	Percent
Paper-based Graphic Organizers		
Assisted Student Writing		
Easy to Manipulate/Use	5	22%
Organization	2	9%
No Spell Check Distractions	2	9%
Hindered Student Writing		
Limited Space to write	7	30%
Handwriting required	4	17%
Hard to Erase	2	9%
Longer to Develop/	2	9%
Hard to generate Ideas		
Digital Graphic Organizers		
Assisted Student Writing		
Organization	6	26%
Additional Writing Space	6	26%
Easy to Manipulate/Use	4	17%
Neat Presentation (No handwriting)	3	13%
Visually Motivating	3	13%
Spell Check-Useful	3	13%
Aesthetically Pleasing	2	9%
Fun	2	9%
Quick to Develop	2	9%
Hindered Student Writing		
Typing – Lack of Fluency (T)	4	17%
Technical Issues other than typing	4	17%
Spell Check was distracting	3	13%
Couldn't Find specific Pictures	3	13%

Note. The following were only identified once: Advantages of paper-based graphic organizers: fun, looks original, no printer needed, no technical issues as concerns, and more freedom to write based on 14 student responses; Disadvantages of paper-based graphic organizers: no spell check and could not manipulate boxes based on 17 student responses; Advantages of digital graphic organizers: kept me on task and permanent way to save based on 34 student responses; Disadvantages of digital graphic organizers: technical - alignment, technical - text deletion issues, technical– things didn't work, and technical – boxes wouldn't expand based on 14 student responses; T-Technical Issues

Summary

Chapter Four presented descriptive and inferential statistics for research questions one and two that examined the impact of paper-based graphic organizers and digital graphic organizers on the persuasive writing of fourth and fifth grade students. In addition, the qualitative research questions provided information on student perceptions toward paper-based graphic organizers and digital graphic organizers as a tool for supporting persuasive writing.

The most salient points in the current study indicate significant improvements on all five outcomes: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores for students who used digital graphic organizers first, with medium to large effect sizes. Likewise, when using paper-based graphic organizers first, there were also significant changes in the following three areas: supporting arguments, conclusion statements, and overall scores with large effect sizes. Students aged 10-11 who used digital and paper-based graphic organizers first showed significant improvements in all five areas with medium to large effect sizes. In addition, there were significant changes, for females, in all five areas when using digital graphic organizers first with large effect sizes.

The recent use of paper-based graphic organizers, after prior digital use, resulted in significant changes in the following four areas: reasoning statements, supporting arguments, conclusion statements, and overall scores with medium to large effect sizes. Subsequently, the recent use of digital graphic organizers, after prior paper use, also resulted in significant changes in the following three

areas: supporting argument, conclusion statements, and overall scores with medium to large effect sizes.

For research question two, there were no consistent significant findings (across both post-tests) for the quality of persuasive writing, when comparing the use of paper-based graphic organizers to digital graphic organizers, at the same point in time (post-test 1 and post-test 2) for organization, tone, spelling, and grammar for all study participants. However, when observing data across post-test 1 only, males tend to improve in the area of organization with digital graphic organizers. Comparably, female students and older students (aged 10-11) improved in the area of spelling with digital graphic organizers.

The data collected from students' interviews revealed that there was a difference in student perceptions toward the writing assignment when using digital graphic organizers as compared to paper-based graphic organizers. Of the students interviewed, 22 out of 23 students (96%) indicated a preference of using digital graphic organizers over paper-based graphic organizers.

Overall, data suggests that both paper-based graphic organizers and digital graphic organizers lead to significant findings in improving the content items of a persuasive writing essay. Likewise, the use of both organizer types also leads to significant improvements for older students aged 10-11.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of the current study, interpretation of findings, and implications drawn from the detailed findings from Chapter 4. In

addition, recommendations for future research studies and practical use of digital and paper-based graphic organizers by teachers and school-based technology coordinators are provided.

Overview of the Study

The purpose of the current study is to examine and provide further research on the impact of digital graphic organizers, as compared to paper-based organizers, as a tool to improve the persuasive writing of fourth and fifth grade students with a focus on the following nine writing outcomes: goal statements, reasoning statements, supporting arguments, conclusion statements, organization, tone, spelling, grammar, and overall scores.

A review of literature on graphic organizers revealed that graphic organizers have a positive impact in assisting students with writing (Cook, et al., 2001; Lorber, 2004 Unzueta, 2009) and serves as an intervention to support students struggling with writing and those with learning disabilities. When examining studies that focus on writing and writing to persuade, the researchers utilized digital graphic organizers as an intervention tool to support student learners (Lorber, 2004; Unzueta, 2009).

This current study was conducted to provide research-based recommendations to the field on instructional interventions that may lead to improving the quality of student writing. Consequently, this will also contribute to the growing body of research on the impact of digital graphic organizers on the writing process. Little research has been conducted that specifically explores the impact of digital graphic organizers on the writing process as a strategy to

support students with writing (Blankenship, et al., 2005; Burgess, 2008; Franciscone, 2008; Lorber, 2004; Unzueta, 2009; Unzueta & Barbetta, 2012). It is probable that the widespread adoption of the Common Core State Standards Initiative (2013) will result in an increased focus on improving student writing while using appropriate technologies. Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects focus on students mastering a variety of skills, including writing. Consistent with the current study, these standards include a focus on the development of topic sentences, reasoning statements, supporting details, organization, tone, and editing which provides an opportunity to addess both spelling and grammar.

The research examines and reports improvements in student writing and shares student perceptions resulting from the use of paper-based graphic organizers and digital graphic organizers. The existing body of research shows that graphic organizers support student writers in improving the quality of their goal/thesis statements, reasoning statements, and essay organization. Furthermore, overall writing scores improved when using graphic organizers. Classroom teachers, technology coordinators, and school administrators should be aware that several researchers have indicated, through studies, that the use of graphic organizers play a significant role in improving student writing (Davies, 2008; De La Paz & Graham, 1997; Graham & Harris, 2003; Jacobson & Reid, 2010; Lorber, 2004; Mason, Benedek-Wood, & Valasa, 2009; Nussbaum & Schraw, 2007; Santangelo & Olinghouse, 2009). In addition, the use of graphic

organizers also contributes to positive feelings and perceptions toward student learning (Drapeau, 1998; Lorenz, Green, and Brown, 2009; Sturm & Rankin-Erickson, 2002).

This current study was guided by the following three research questions:

1. Is there a significant difference when fourth and fifth grade students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers in terms of how well the goal of the paper is written, the number of quality statements written that provide sound reasoning, the number of quality statements written that provide sound supporting arguments, how well students summarize personal opinions in a strong concluding statement, and the overall scores of the persuasive writing essay.

   a. Is there a significant difference in the pre- and post-test scores, based on age and gender, when fourth and fifth grade students develop persuasive writing essays using digital graphic organizers as compared to paper-based graphic organizers?

2. Is there a significant difference when fourth and fifth grade students use digital graphic organizers, as compared to paper-based graphic organizers, in how well they organize the overall paper, when using a choice of words (tone) that are descriptive, the number of spelling errors, and the number of

grammatical errors throughout the persuasive writing essay?

    a. Is there a significant difference based on age and gender when fourth and fifth grade students use digital graphic organizers, as compared to paper-based graphic organizers, in how well they organize the overall paper, when using a choice of words (tone) that are descriptive, the number of spelling errors, and the number of grammatical errors throughout the persuasive writing essay?

3. Do student perceptions toward the writing assignment differ when using digital graphic organizers as compared to paper-based graphic organizers?

Study participants included a total of 67 students from four different classrooms located in Central Illinois and within two different school districts (public and private). The research questions were answered through use of a quasi-experimental study with a comparison (control group) design with pre-test and post-tests. The switching replication method was used by administering a second treatment, at a later date, to the group that originally served as an alternative comparison group. Research data related to student perceptions were generated by conducting a series of student interviews with a total of 23 students representing classrooms that participated in the current study.

Findings and Interpretations

Graphic organizers are instructional tools that are instrumental in providing support to students to help improve persuasive writing. The current study

resulted in significant findings that indicate that both paper-based graphic organizers and digital graphic organizers lead to an overall improvement in persuasive writing, including how well students write their reasoning statements, supporting arguments, and conclusion statements. This is consistent with Cook, et al., (2001) who indicated that students improved their supporting arguments and conclusion statements, but inconsistent with the portion of their study that indicated that students improved how well they wrote goal statements. When using a digital graphic organizer, students showed significant improvements in how well they addressed all five outcomes: goal statements, reasoning statements, supporting arguments, conclusion statements, and the overall scores. The improvements of how well students developed supporting details (Unzueta, 2009), and realized gains in the overall scores of their writing essays (Lorber, 2004) are consistent with prior digital graphic organizer research.

Persuasive Writing Content Items: Research Question One

The research data indicates that persuasive writing significantly improved among fourth and fifth grade students, when using digital graphic organizers first across the following five writing outcome areas: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores with medium to large effect sizes. These findings suggest that digital graphic organizers are beneficial to students as they develop persuasive writing essays, and as they begin to identify strategies and tools that help enhance their persuasive writing. Existing researchers have indicated that identifying contributing factors that lead to specific and overall improvements in student

writing continues to be an area worth examining as digital graphic organizer research continues to evolve (Lorber, 2004; Unzueta, 2009).

The use of digital and paper-based graphic organizers, at post-test 1, led to significant improvements, for older students (aged 10-11), in the following five writing outcome areas: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores with medium to large effect sizes. The use of a digital graphic organizer first leads to significant improvements, for younger students (aged 8-9), in the following two outcome areas: conclusion statements and overall scores. These findings indicate that older students, as compared to younger students, have greater advantages resulting from the use of a digital graphic organizer. It is likely that the differences in age-based findings were the result of the older students being more cognitively advanced in writing and organizing ideas for writing assignments. By using digital and paper-based graphic organizers, older students tend to show an increase in the quality of how they represent their ideas and persuade the reader through written words. While the Unzueta (2009) study focuses on middle school students, there are no known studies that examine differences in how older students (aged 10-11) write persuasively while using digital graphic organizers.

The use of a digital graphic organizer first leads to significant improvements, for female students, in the following five writing outcome areas: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores with large effect sizes. These findings suggest that organizers have a

distinct benefit for female students, as compared to male students. This is an important finding as it provides new insights for teachers as they address the various learning needs of all students. No known studies exist that examine the impact of gender in persuasive writing when using digital graphic organizers. These results indicate a need for further research to understand if any patterns exist that might confirm gender or age differences when utilizing digital graphic organizers.

The recent use of paper-based graphic organizers, after prior digital use, resulted in significant improvements in the following four writing outcome areas: reasoning statements, supporting arguments, conclusion statements, and overall scores with medium to large effect sizes. Likewise, the recent use of a digital graphic organizer, after prior paper use, resulted in significant improvements in the following three writing outcome areas: supporting arguments, conclusion statements, and overall scores with medium to large effect sizes. These findings indicate that paper-based graphic organizers also contribute to improved persuasive writing in fourth and fifth grade students. Like digital graphic organizers, paper-based should also be provided to students as an instructional support tool to enhance writing. Ultimately, paper-based graphic organizers cost less, are more portable, and have fewer technical issues, while digital graphic organizers allow for easy revision of text and provide opportunities to easily expand text without space limitations. This finding is consistent with studies that show that paper-based graphic organizers improve student writing (Meyer, 1995; Nussbaum & Schraw, 2007), and digital graphic organizers also improve student

writing (Lorber, 2004; Unzueta, 2009). However, additional research studies are necessary to further examine if an initial exposure to a digital graphic organizer after prior paper use, or initial exposure to a paper-based graphic organizer after prior digital use, led to improvements since study participants had familiarity with these tools prior to the post-test 2 exposure. Related to exposure, future researchers might consider whether or not the length of time between the initial exposure and final exposure has an impact on student writing.

Similar to digital graphic organizers, the use of paper-based graphic organizers first results in significant improvements in the following three areas: supporting arguments, conclusion statements, and overall scores with large effect sizes. This finding further strengthens the previously stated claim regarding the recent use of paper-based graphic organizers after prior digital use. This substantiates the claim that paper-based graphic organizers are potentially useful tools in improving how students write to persuade. Furthermore, this finding is consistent with Nussbaum & Schraw (2007) who explored the impact of promoting the development of arguments and counter-arguments in written essays. In the current study, students improved how they wrote their supporting arguments, in addition to the conclusion statements, and overall scores when using paper-based organizers first.

Persuasive Writing Process Mechanic Items: Research Question Two

The quality of persuasive writing essays were also measured by the following process mechanic writing outcomes: organization, tone, spelling, and grammar.

Based on gender, the data in the current study suggests that female students benefited from improved spelling when using digital graphic organizers, while males seem to improve in their overall organization of their persuasive writing essays. Although the Harrington, Holik, and Hurt (1988) study did not focus on gender, the researcher reported that spelling improved when students used a digital graphic organizer. While there are no known gender-specific studies focused on the use of graphic organizers and persuasive writing, these findings are important as teachers continue to identify, evaluate, and use instructional tools to support student writers. However, the results are consistent with current research that indicates that there are significant improvements in spelling and organization (Barbetta & Unzueta, 2012, Lorber, 2004; Unzueta, 2009) when students utilize digital graphic organizers to assist with writing.

Student Voices: Digital and Paper Graphic Organizer Use

When comparing digital to paper-based graphic organizers, students prefer to use digital graphic organizers. While both organizers have advantages and disadvantages, students may be willing to overlook the disadvantages of digital graphic organizers as they articulated strong preferences, overall, in the use of digital graphic organizers. This is consistent with an earlier study comparing paper-based graphic organizers to digital graphic organizers, that reported that the advantages of digital graphic organizers overcome most disadvantages of using paper-based graphic organizers (Lin, Strickland, Ray, & Denner, 2004). This finding is important for classroom teachers that support the philosophy of providing students with opportunities to choose how they meet agreed upon

learning goals in classroom assignments. The data suggests that students

(n=23) enjoy using both types of graphic organizers and 96% prefer the use of a

digital graphic organizer. Students perceive that there are more advantages, and

fewer disadvantages to using digital graphic organizers, as compared to paper-

based graphic organizers.

The current study suggests that digital graphic organizers provide additional

writing space, create neat presentation of ideas, are visually motivating, have a

useful spell check feature, produce aesthetically pleasing organizers, are fun to

use, and quick to develop. Paper-based graphic organizers eliminate spell check

distractions, while both paper-based graphic organizers and digital graphic

organizers are easy to use and help students to organize their writing. Similar to

the Lorber (2004) study, digital graphic organizers, through student interviews,

were identified as providing an advantage in assisting students with organization

of ideas.

Paper-based graphic organizers can be a hindrance to students in that they

have limited space to write their ideas, they have to use handwriting, they are

more difficult to modify because students have to erase errors, and paper-based

graphic organizers made it more difficult to generate ideas for the persuasive

writing essay. This was in contrast to the Lorber (2004) study, where students

indicated, when using a digital graphic organizer, they had a hard time getting

started with idea generation. Consistent with earlier research, Lorenz, Green,

and Brown (2009) indicated that students preferred computer-generated maps

because handwritten maps were sloppy and harder to modify. Also, Lin,

Strickland, Ray, and Denner (2004) reported that it was hard for students to make corrections when using paper-based graphic organizers. However, the current study suggests that digital graphic organizers had disadvantages, though fewer, in that they were difficult to use for students with a lack of typing fluency, the spellcheck tool was a distraction, and students were unable, at times, to find specific pictures they wanted to use on the digital graphic organizers.

These findings are informative to classroom teachers when they begin using paper-based graphic organizers and digital graphic organizers. It provides key information on how best to improve the experience for students by working to address some disadvantages of the selected graphic organizer prior to and during student use to create a more pleasant experience.

For example, when using paper-based graphic organizers, teachers should consider selecting those with larger areas to write. Likewise, when using digital graphic organizers, teachers could make sure students have had opportunities to gain basic computer literacy skills and focus time to teach students how to search for pictures to enhance their organizers.

Also, understanding the advantages of each organizer type creates opportunities for teachers to make more informed choices as to which organizer to use, when options are available. These informed choices should be made based on understanding the diverse learning needs of students in the classroom, and reflecting on and identifying the type of graphic organizer that would best support students based on their individual needs as learners. For example, students struggling with spelling may benefit from using digital graphic

organizers, while students that are not proficient in technology may benefit from using a paper-based graphic organizer.

Limitations

The limitations in the current study include short treatment times (duration of study), testing (impact of pre-test essay and previous organizer use), setting (researcher presence), sample size (specific to race, age, and disabilities), and history (time lapse).

The current study was limited by short treatment times due to the following: time constraints related to school testing schedules, scheduled days off, and access to computers. Due to the timing of the current study, the researcher scheduled lessons and interviews within specific and varied scheduling blocks to accommodate the school schedule related to mandated testing in public schools, field trips, school-wide programs, enrichment activities, detention, and availability of the computer lab or mobile cart. Ideally, students would have a constant block of time, daily and weekly, but it was essential that the research schedule remain flexible, yet consistent, within the agreed upon time frames. As a result, findings may not be relevant to lessons that require rigid schedule blocks and lessons that require a longer duration of time for completion.

Another limitation in the research is testing. By design, study participants were pre-tested and this may have altered how they responded to the subsequent writing prompts since they were exposed to a similar writing to persuade prompt at the outset of the current study for purposes of pre-testing. Participants also received both (paper-based graphic organizers and digital

graphic organizers) treatments, at different points in time as post-tests and for training purposes. As a result, initial exposure and familiarity may have altered how students responded to the use of the treatment when it was administered the second time. However, based on data from the current study, this exposure apparently did not result in significant impact.

The setting may serve as a limitation in that the researcher was visible in the room during the current study. This step was necessary to ensure that the lesson plans were followed, in accordance with the treatment fidelity procedure sheet and checklist. On occasion, the researcher was able to interject to ensure that steps were not omitted. This presence and interaction may have caused study participants to react differently to the treatments since they may have been aware that they were participants in a study. The parental consent forms included a section where students would acknowledge, through initials, their participation in the study. As a result, researcher presence could have impacted how students responded as they became aware that they were being observed. Consequently, this could have led to student data that fails to represent typical performance of the student. To minimize this, and in accordance with the informed consent forms, students did not receive any detailed specifics on the nature of the research from the researcher. The researcher had minimal contact as the lead on the lesson implementation, as classroom teachers were made aware that they would facilitate the lessons.

In addition, the sample size of the current research study is a limitation. While the current study had the potential to reach a total of 100 students, despite

multiple outreach efforts to parents, the current study included a total of 67 subjects with signed parental consent forms. This number also changed, due to missing data related to absences, when statistical tests required comparisons between the two treatment groups. As a result, sample size varied based on the following: Pre-test Digital First/PS (n=31) and Paper First/DS (n=30), Post-test 1 Digital First/PS (n=36) and Paper First/DS (n=31), and Post-test 2 Digital First /PS (n=35) and Post-test 2 Paper First /DS (n=30).

Consequently, due to the sample size, these current results may not be able to be generalized to larger populations within school settings associated to race, age, and students with disabilities. While this research study includes students with diverse backgrounds, the population of Asian (n=5), Asian/Middle Eastern (n=2), Latino/a (n=1), and Multiracial (n=5) are notably small. While there is an even distribution of the targeted population of students, aged 8-9 (n=34) and 10-11 (n=33), the current study could not be generalized to students younger than or older than the targeted population in the current study. As for documented learning disabilities, the current study is representative of a very small number of students with an emotional disturbance (n=2), learning/processing disabilities (n=1), learning disability (n=1), and a speech or language disability (n=4). Likewise, the current study cannot be generalized to any specific learning disabilities

Finally, history of the current research serves as a limitation. There was a time lapse of at least one week between post-test 1 and 2, in relationship to when the pre-test was administered across all four classes. Subsequently, this

time lapse could have caused other external factors to contribute to differences in persuasive writing. It is likely that the time lapse could impact student writing and, as previously mentioned, could be an area for future research.

While it is imperative in research to identify limitations, this should not diminish the overall results of the current study. Instead, the acknowledgement of these limitations provide an opportunity to adequately reflect on what has been explored and examined in research. This also provides an opportunity for future research to be designed and conducted in a manner to address limitations.

Conclusions and Implications

An implication of these findings is that both paper-based and digital graphic organizers should be made available for student use when they are developing persuasive writing essays. Graphic organizers, both paper-based and digital, were effective in improving persuasive writing across the following writing outcomes: goal statements, reasoning statements, supporting arguments, conclusion statements, organization, spelling, and overall scores. The current study also implies that graphic organizers serve as an instrumental tool to aid students in writing, while serving as an intervention tool for students that require targeted support in improving the following elements of an essay structure: goal statements, reasoning statements, supporting arguments, and conclusion statements and in improving the quality of the persuasive writing essay through the following elements: organization and spelling.

Another important practical implication, focused on age and gender, suggests that teachers with split classrooms (with older students aged 10-11), or those

teaching all students aged 10-11 might consider providing opportunities to utilize digital graphic organizers or paper-based graphic organizers as they both resulted in consistent and significant improvements in persuasive writing, as compared to younger students (ages 8-9).   In addressing instructional practice, the use of paper-based graphic organizers and digital graphic organizers provide opportunities for classroom teachers to meet the needs of their students by addressing individual learning needs associated with persuasive writing.

Advantages of Digital Graphic Organizers

While the current study acknowledges that both paper-based and digital graphic organizers are effective, this section will focus on specific advantages of digital graphic organizers followed by advantages of paper-based graphic organizers. The current study implies that when fourth and fifth grade students are writing to persuade, digital graphic organizers should be introduced to assist and support writers. The information contained in this current study can be used to develop targeted interventions aimed at assisting students struggling with persuasive writing. For example, based on student interviews, students struggling with spelling should consider using digital graphic organizers to have access to a digital spell check tool as writing is initially developed. The improvements in spelling could be directly related to testing an outcome that relies on students using a traditional dictionary to assist with spelling, as compared to a digital spell check functionality that allows students to be notified of potential spelling errors.   This improvement could be directly related to being made aware of a potential error and having an opportunity to check for an error.

This is consistent with an earlier study that indicated that the use of digital graphic organizers led to improvements through use of the spell checking functionality (Harrington, Holik, & Hurt, 1988).

Students struggling with organization should also have access to a digital graphic organizer to be able to quickly and easily modify text to aid in better organization of a persuasive writing essay. When working with females (i.e. gender-based settings), one might consider introducing the use of digital graphic organizers as this group realized significant improvements in how they structured persuasive writing essays through the goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores with access to that tool. One might speculate, based on results of the current study, that using a digital organizer allowed for more opportunities to easily modify, revise, and enhance the organizer through use of the abundance of formatting tools included in the software. It is plausible that this digital graphic organizer feature led to improvements in how male students organized their persuasive writing essays. Consequently, the use of a digital graphic organizer could provide added benefits by supporting male students as they become better writers through better organization of written essays. This is consistent with the Unzueta (2009) study, which reported an increase in the overall organization of a persuasive writing essay when using digital graphic organizers. While the Unzeuta (2009) study included male students, it did not focus specifically on males. Future studies could focus on the impact of paper-based and digital graphic organizers on persuasive writing, specific to gender differences.

The technical nature of a digital graphic organizer provides opportunities for students to not only focus on filling in the blanks, but to move beyond that scope of thinking and own the graphic organizer as a learning tool (Lapp, Wolsey, & Moss, 2013). During the current study students had opportunities to really take control of and "own" their digital graphic organizers through their abilities to revise, enhance, format, and customize both text and graphic organizer boxes. As students own their digital graphic organizers, they will likely want to edit and modify them during the development process as they document and develop ideas for the final persuasive writing essay.

In thinking about the spatial relationship, classroom teachers should provide digital graphic organizers for student use because they provide ample space for students to write. Student interviews (as noted in Table 17) revealed that this was a strong advantage of digital graphic organizers as compared to paper-based graphic organizers. These findings support the assertion that ample space provided through use of digital graphic organizers was a contributing factor that resulted in improvement in persuasive writing, especially when students needed to develop more text to communicate thoughts. This is consistent with a study by Crooks, White, and Barnard (2007) that revealed that large graphic organizers had better results when used for summary notes. Unzueta (2009) also reported that there was an increase in the number of supporting details planned when students used digital graphic organizers to support persuasive writing. It is probable that students wrote more supporting details because when using a digital graphic organizer they were not limited to a specific amount of space.

Another implication for digital graphic organizer use is that classroom teachers and technology coordinators will need to address technical issues around digital graphic organizers and remove technical barriers by instituting a course or providing another form of support to students that will increase technology proficiency skills and provide opportunities to learn how to use advanced tools in digital graphic organizer software such as spelling and searching for pictures. These technical barriers were discussed during student interviews, and students lacking proficiency in technology indicated several technical disadvantages of using digital graphic organizers. These disadvantages ranged from a lack of typing/technology fluency 17%, to the inability to correct several other technical issues 17% (i.e. alignment, text deletion, things not working, and boxes not expanding). Notably, students proficient in technology corrected any technical nuances as they developed digital graphic organizers.

In addition to the aforementioned advantages of digital graphic organizers, study participants revealed a preference of using digital graphic organizers as compared to paper-based graphic organizers when writing to persuade. While preference alone should not inform which organizer type to use, classroom teachers and technology coordinators that are interested in creating constructivist learning environments, that empower students, should make available opportunities for students to use and have access to computers for educational use.

Advantages of Paper-based Graphic Organizers

The findings of the current study also have a number of important implications for the use of paper-based graphic organizers in classrooms. When using paper-based graphic organizers, across all study participants, significant improvements were realized for the following elements of essay structure: reasoning statements, supporting arguments, conclusion statements, and the overall scores. As a result, paper-based graphic organizers should be made available for use amongst all students. The findings in this current study are consistent with the existing body of research that explores the use of paper-based graphic organizers (Anderson-Inman, Ditson, & Ditson, 1998; Ausubel, 1960; Blankenship et al. 2005; Bruillard & Baron, 2000; Chiou, 2008; DiCecco & Gleason, 2002; Gerstner & Bogner, 2010; Hay, Kinchin, & Lygo-Baker, 2008; Kwon & Cifuentes, 2007; Meyer, 1995; Royer & Royer, 2004; Sturm & Rankin-Erickson, 2002). As with digital graphic organizers, further research is needed to examine any differences in the impact of paper-based graphic organizers as it relates to age and gender.

Similar to digital graphic organizers, teachers should take into consideration the specific writing needs of students and select a paper-based graphic organizer that can target a specific area such as: reasoning statements, supporting arguments, conclusion statements, and overall scores while serving as an intervention tool to assist students based on individual learning needs. To further support students, if paper-based graphic organizers are going to be provided to

students, both classroom teachers and technology coordinators should consider providing organizers that have large text boxes or consider using larger pieces of paper to better target areas of need and to eliminate frustrations connected to space.

It is plausible that a lack of technology proficiency was a direct result of why students identified advantages of using paper-based graphic organizers. Based on student interviews (as indicated in Table 17), students identified a total of 14 disadvantages of digital graphic organizers that related to technical issues that more proficient users of technology might not have encountered. An implication of paper-based graphic organizers is that they can be used as a transitional tool as students become proficient users of technology. They can also serve as a primary instructional tool to assist in providing writing support for students as an alternative to using technology.

Additional studies are needed to further examine 1) the relationship of prior exposure to graphic organizers (of either type) and the impact that has on student writing, and 2) the impact of specific types (digital and paper-based) of graphic organizers, in comparison to one another, as it relates to student writing. Based on student interview data in the current study, it appears that the use of both graphic organizer types would be beneficial for use in schools. Additional studies are needed to further explore student perceptions and how those may impact improvement of persuasive writing when using paper-based graphic organizers or digital graphic organizers.

Recommendations for Further Study

This section presents recommendations for different aspects of future research on the impact of graphic organizers on student writing. From the results of preliminary analyses, research suggests that females recognized greater improvements in persuasive writing when using digital graphic organizers, as compared to paper-based graphic organizers. Future research on the impact of digital graphic organizers on the writing process should include a more concentrated effort to disclose any differences that may occur through a larger sampling of participants with a focus on gender.

The current study did not investigate whether or not computer literacy levels of students had an impact on improved persuasive writing when using digital graphic organizers. When combining all technical issues, 35% of students mentioned technical concerns as a disadvantage of digital graphic organizers. It is probable that students lacking technology proficiency skills were at a disadvantage when using digital graphic organizers.

The school setting, in terms of access to technology, was also not examined in the current study. However, it became clear that much flexibility was needed to adapt to the availability of technology resources. In regard to time spent on assignments and uninterrupted time, it is plausible that easy access to technology via a 1:1 student to computer ratio could yield more positive results providing students with uninterrupted time, with fewer constraints, to develop graphic organizers and then complete a writing task.

Recommendations for Practices

Recommendations for Teachers. The results of the current study suggest that teachers should consider incorporating the use of graphic organizers (both paper-based graphic organizers and digital graphic organizers) into classroom practice for improved results in writing. Teachers can also use graphic organizers as an instructional support tool that targets specific writing outcomes to meet individualized student needs. According to Lubin and Suwak (2007) educators should use graphic organizers as a method to meet the needs of all learners. This provides an opportunity to increase and address the following writing proficiency skills, while addressing the specific needs of each student in the following areas: goal statements, reasoning statements, supporting arguments, conclusion statements, organization, and spelling.

Recommendations for School-Based Technology Coordinators. The results of the current study indicate that school-based technology coordinators should include digital graphic organizer software as a part of the district-adopted software as an instructional tool to support student writers. Based on findings from student interviews, the software selected should provide students with ample space to write/type, have an aesthetically pleasing output, include a digital spell check feature, and be easy to use.

In addition, school-based technology coordinators should consider providing opportunities to increase technology proficiency levels in students. Based on student interviews, students indicated multiple concerns regarding typing fluency (n=4) and other technical issues and concerns (n=4). By addressing basic

computer literacy, students will likely become more proficient users of technology, which will subsequently increase the overall comfort and productivity levels of students when using digital technologies.

School-based technology coordinators should provide support to students, and assist teachers, by providing access to paper-based graphic organizers. This provides an opportunity for students to select the type of organizer they prefer to use. Also, in settings where computers are not available this provides students with the opportunity to still use an organizer to aid in their writing. These paper-based graphic forms or structured worksheets could also be printed documents directly from the digital graphic organizer software. In making available both types of organizers, school-based technology coordinators should be mindful that several researchers indicated that there is an increase in motivation when students are given the opportunity to use graphic organizers (Cook, et al., 2001; Etchison, 1995; Lorenz, Green, & Brown, 2009). By providing access to paper-based and digital graphic organizers, and providing opportunities for students to become proficient users of technology, it is probable that students will have increased levels of motivation toward persuasive writing assignments.

Summary

This concluding chapter includes recommendations for teachers and school-based technology coordinators to help improve persuasive writing and to seamlessly integrate the use of digital graphic and paper-based graphic organizers into classroom practice. Overall, the current study suggests that both

paper-based graphic organizers and digital graphic organizers lead to significant improvements in persuasive writing of fourth and fifth grade students.

The current study focused on whether or not the use of paper-based graphic organizers and digital graphic organizers contributed to improved persuasive writing across the following nine writing outcomes: goal statements, reasoning statements, supporting arguments, conclusion statements, organization, tone, spelling, grammar, and overall scores. In addition, data from student interviews provided insights into student perceptions about the use of paper-based and digital graphic organizers.

Based on a review of literature, contributing factors in graphic organizer research that yield improvements in writing include the use of graphic organizers as a) a visual tool that allows learners to develop an approach to organizing their ideas (Anderson-Inman, Ditson, & Ditson, 1998; Ausubel, 1960; Blankenship et al., 2005; Bruillard & Baron, 2000; Chiou, 2008; DiCecco & Gleason, 2002; Gerstner & Bogner, 2010; Hay, Kinchin, & Lygo-Baker, 2008; Kwon & Cifuentes, 2007; Meyer, 1995; Royer & Royer, 2004; Sturm & Rankin-Erickson, 2002), b) an element of an existing instructional strategy that continues to support students as they develop new ideas that contribute to writing (Lorber, 2004; Unzueta, 2009; Unzueta & Barbetta, 2012), c) a visualization tool and learning strategy that facilitates thought (Kwon & Cifuentes, 2007), d) an approach to update content, check for spelling errors, revise, and enhance vocabulary through use of technology (Harrington, Holik, & Hurt, 1988), and e) as an effective approach to brainstorming and planning (Bromley, Irwin-DeVitis & Modlo, 1995; Moss &

Holder, 1988).

The five most prominent results of the current study indicate that 1) the use of a digital graphic organizer first leads to significant improvements in the following five writing outcome areas: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores with medium to large effect sizes; 2) the use of paper-based graphic organizers first, results in significant improvements in the following three areas: supporting arguments, conclusion statements, and overall scores with large effect sizes; 3) the use of paper-based and digital graphic organizers first leads to significant improvements, for older students (ages 10-11), in the following five writing outcome areas: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores with medium to large effect sizes; 4) the use of a digital graphic organizer first leads to significant improvements, for female students, in the following five writing outcome areas: goal statements, reasoning statements, supporting arguments, conclusion statements, and overall scores with large effect sizes; and 5) the recent use of paper-based graphic organizers, after prior digital use, resulted in significant improvements in the following four writing outcome areas: reasoning statements, supporting arguments, conclusion statements, and overall scores with medium to large effect sizes, and the recent use of digital graphic organizers, after prior paper use similarly resulted in significant improvements in the following three writing outcome areas: supporting arguments, conclusion statements, and overall scores.

In conclusion, the overall results indicate that paper-based and digital graphic organizers yield significant improvements in the persuasive writing of fourth and fifth grade students. Furthermore, a consistent finding throughout this study is that the use of paper-based and digital graphic organizers results in significant improvements in these three areas of persuasive writing: supporting arguments, conclusion statements, and overall scores.

APPENDIX A

Parent/Guardian Letter of Informed Consent

Dear Parents:

  I am conducting a research project designed to study
how children plan and develop persuasive writing essays. Students will use
graphic organizers, which guide the learner's thinking and create a visual map or
diagram (Inspiration, 2012) during this project.

  I request permission for your child to participate. The study consists of two
lessons with four fifty-minute sessions.   Children will participate in a lesson using
graphic organizers provided by their classroom teacher that will lead them to
planning for and developing a persuasive writing essay. This study will be well
integrated into the normal learning events in your child's classroom.

  A few students will be selected to participate in an interview that will be
conducted by me. The questions are designed to get a better understanding of
student learning. Any child who desires to end the interview and return to the
classroom will be immediately released from the interview portion of the study.
Children's responses will be reported as group results only and children will not
be identified by name. I will retain interview data logs at the study's conclusion.
These data logs may be viewed by the child's teachers, researchers, and
teachers and may be shared during professional conferences. To preserve
confidentiality, only unique identifiers will be used to identify children. In addition
to lesson and interview participation, I will need to look at the school's records in
order to obtain basic demographic information about your child.

  Your decision whether or not to allow your child to participate will in no
way affect your child's standing in his or her class/school. At the conclusion of the
study, a summary of group results will be made available to all interested parents
and teachers. Should you have any questions or desire further information,
please contact me at mthoma13@students.towson.edu, or you may contact my
advisor, Dr. David Wizer at 410-704-6268 or Dr. Debi Gartland, Chairperson of
the Institutional Review Board for the Protection of Human Participants, at 410-
704-2236. Thank you in advance for your cooperation and support.

     Sincerely,

     Mila Thomas-Fuller
     Dept. of Educational Technology
     & Literacy

INFORMED CONSENT FORM: Parental Consent Letter
(continued)

Please indicate whether or not you wish to have your child participate in this project by checking a statement below and returning this letter to your child's teacher as quickly as possible.

_____ I grant permission for my child,

_____, to participate in this project.

_____ I do not grant permission for my child, _____, to participate in this project.

_____ Affirmative agreement of child

_____   _____
Parent/Guardian's signature   Date

_____

THIS PROJECT HAS BEEN REVIEWED BY THE INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN PARTICIPANTS AT TOWSON UNIVERSITY (PHONE: 410-704-2236), the UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN BUREAU OF EDUCATONAL RESEARCH, AND THE URBANA SCHOOL DISTRICT.

APPENDIX B

Lesson Plan: Dear Librarian

Estimated Time: Four 50-minute sessions

OVERVIEW
Students will be asked to think about the choices they would make if they had an opportunity to oversee a library and select books made available to visitors. Students will consider the types of books the library would have and will be given the opportunity to write an authentic letter to their school librarian requesting that a specific book be added to the school library collection. Students will use persuasive writing skills to write letters stating their cases. Students will then have an opportunity to share their letters with the librarian.

MATERIALS AND TECHNOLOGY
- Graphic Organizer (Digital or Paper Based) – The graphic organizer will enable students to map out their arguments for a persuasive essay.
- Persuasive Letter Rubric
- STOP and DARE Handout

STUDENT OBJECTIVES

Students will

- develop and support a position on a particular book by writing a persuasive letter about their chosen title.
- use a graphic organizer to help them organize their persuasive ideas into written form.
- develop a persuasive piece that expresses points in a clear, logical sequence so the reader can follow their reasoning.
- publish their persuasive piece as a letter.

Session One

1. Invite the students to share details about a favorite book, using the following questions to guide the discussion:

   o What makes it your favorite book?
   o How did you first hear about that book?
   o Have you asked any of your friends to read that book? Why?

2. Playing off the last discussion question, ask the students whether they have ever read a book that was recommended to them by others. Use the following questions to guide discussion:

   o Have you ever read a book that someone suggested you read?
   o Did you enjoy reading the book

3. Ask students if they have ever looked for a book at the library and found that it was checked out or that the library did not own a copy. Ask student volunteers to share how such an experience made them feel. If students have not had that experience, share one of your own.

4. Invite students to problem solve, focusing on the question, "If there is a book that you really want for the library, what can you do?" Students' responses will vary. Explain to students that they can write a letter to the librarian asking for a copy of the book to be purchased.

5. Explain that students will prepare to write a persuasive letter to their librarian, requesting that a book they are interested in be added to the library collection.

6. Introduce the idea of persuasive writing by introducing STOP, which will ask students to suspend judgment, take a side, organize ideas, and plan more while they write.

7. Discuss the Persuasion Map and walk through the components of a persuasive piece of writing.

8. After students have been introduced to the Persuasion Map, share the Persuasive Writing Letter Rubric so they understand the target for the project and what is expected of them.

9. Answer any questions that the students have about persuasive writing or their persuasive writing project.

Session Two

1. Demonstrate the paper-based graphic organizer or the digital graphic organizer that students will use to for a persuasive essay.

2. Answer any questions that students have about the paper-based or digital graphic organizer and the writing assignment.

3. Introduce DARE, the four step process that encourages students to develop a topic sentence, add supporting ideas, reject at least one argument for the other side and support their opinion, and end with a conclusion.

4. Allow students the rest of the session to continue organizing their ideas and create finished copies of their work using either the paper-based or digital graphic organizer.

5. Explain that students will use the graphic organizers during the next session to create their letters.

Session Three
1. Post the name and address of the librarian(s) that students will write to on the board for use during the session.

2. Using their paper-based or digital graphic organizer as a guide, ask students to write their persuasive letters, requesting that a book they are interested in be added to the library collection.

3. Discuss the parts of a business letter using the business letter model provided.

4. Answer any questions that students have about the business letter format and their assignment.

5. Allow students the rest of the session to organize their ideas, and create finished copies of their work.

6. Keep the Persuasive Letter Rubric available so students can make sure that they include all necessary components.

7. Explain that students will share their letters with a partner during the next class and some students will have an opportunity to share with the class.

Session Four

1. When students have completed their letters, invite them to share with a partner. Ask for student volunteers to share with the whole class.

2. Arrange for a visit to the library to deliver the letters to the librarian, and answer any questions about their letters.

APPENDIX C

Lesson Plan: A Case for Reading

Estimated Time: Four 50-minute sessions

OVERVIEW
Any work or product is potentially open to attack by someone, somewhere, sometime, for some reason. This lesson introduces students to censorship and banning of items.

MATERIALS AND TECHNOLOGY
- Graphic Organizer (Digital or Paper Based) – The graphic organizer will enable students to map out their arguments for a persuasive essay.
- Persuasive Letter Rubric
- STOP and DARE Handout

STUDENT OBJECTIVES

Students will:

- discuss issues of censorship, challenged, or banned books and products.
- examine issues of censorship as it relates to a specific literature title.
- develop and support a position on a particular book or product by writing a persuasive essay.

Session One

1. Display or read some of the items on the list of challenged and banned books. Explain that although many of these items have been made for children explain that they have been banned or they are under discussion (challenged) of being banned in some schools.
   a. Challenged Children's Books list || Banned Books List
      Example: Harry Potter Books by J.K. Rowling and Where the Wild Things Are by Maurice Sendak
   b. IPODS
   c. Junk Food
   d. Mobile Phones

2. Ask students to brainstorm a definition of censorship and record the students' ideas on the board or chart paper. When you have come up with a definition the group agrees on, have students read the definition. Then

share the American Library Association's definitions: A banning is the removal of those materials.

3. Have students brainstorm ways in which books, products, and services are banned for children. If they don't come up with examples share the following: Internet filtering, ratings on movies, video games, music, and self-censoring (choosing to watch only one news show or choosing not to read a certain type of book). Ask them if they know why those books, products, or services were found to be controversial.

4. Allow time for students to share these examples with their classmates and offer an explanation of why they think these items were banned, censored, or challenged.

5. Explain to students that they will write a persuasive piece stating what they believe should be done with a book or product that they choose from a list that has been banned. They may choose to 1) persuade the school or business to allow the item, or 2) persuade the school or business to remove the item from the school. Students will select an item from the list below or recommend other items that they may be familiar with. Items include: Mobile Phones, Junk Food, Portable Video Games, Pets, Music Devices, and Book Titles.

6. Introduce STOP, which will ask students to suspend judgment, take a side, organize ideas, and plan more while they write. Remind students that they will have an opportunity to use a graphic organizer before they begin writing. Discuss the Persuasion Map, and walk through the components of persuasive writing.

7. Share the Persuasive Writing Rubric with students so they understand the target for the project and what is expected of them.

8. Answer any questions that the students have about persuasive writing or the project.

Session Two

1. Explain that students will use either a paper-based or digital graphic organizer to help map out their arguments for the persuasive essay.

2. Introduce DARE, the four-step process that encourages students to develop a topic sentence, add supporting ideas, reject at least one argument for the other side and support their opinion, and end with a conclusion.

3. Allow students to begin organizing their ideas using either a digital or paper-based graphic organizer.

4. Explain that students will use their graphic organizers to develop the final writing essay.

Session Three

1. List the school (or business) address of individuals (librarian, teacher, school administrator, directors, etc.) that students will have an opportunity to write letters to for the assignment.

2. Remind students that they will write a persuasive piece stating what they believe should be done with a product or book that is currently banned or challenged, or one that is not currently banned or challenged. They may then choose to 1) persuade the school to allow the item in the building, or 2) persuade the school to remove the item from the school for the upcoming school year. Students will select items from the list below or recommend another item.

   o Mobile Phones
   o Junk Food
   o Portable Video Games
   o Pets
   o Music Devices

3. Share the business letter model provided and discuss the parts of a letter.

4. Answer any questions the students may have about the assignment.

5. Allow students to begin writing their persuasive letters

Session Four

1. Invite students to share their persuasive pieces with the rest of the class. It is their job to persuade teachers, librarians, or administrators to 1) keep the book or item, 2) remove the book or item, or 3) add the book or item to the school.

APPENDIX D

Persuasive Writing Scoring Rubric

	4	3	2	1
Goal or Thesis	There is one goal or thesis statement that strongly and clearly states a personal opinion and identifies the issues.	There is one goal or thesis statement that states a personal opinion and identifies the issue	There is one goal or thesis statement but it does not clearly state a personal opinion. There is little reference to the issue.	There is no personal opinion.
Reasoning Statements	Three or more excellent reasons are made. It is evident the writer put much thought and research into this assignment.	Three or more reasons are stated.	Two reasons are made but with weak arguments or no arguments.	Less than two reasons are made and the arguments are weak or missing.
Supporting Arguments (Facts or Examples to support the reasons)	Well-researched supporting arguments are made for three or more reasons. The author does an excellent job of persuading	The supporting facts or examples are good for three or more reasons, but weak in some places. The writer doesn't persuade completely.	The supporting facts or examples are weak for one or two reasons. The writer doesn't persuade the reader.	Arguments are missing
Conclusion	Summarizes personal opinion in a strong concluding statement	Summarizes personal opinion in a concluding statement.	Concluding statement is a weak summary of personal opinion.	Concluding statement makes no reference to personal opinion.
Organization	Paragraphs are complete, well written and varied.	Paragraph structure is generally correct.	Paragraph structure is inconsistent.	Little or no evidence of paragraph structure.
Tone	Choices of words are descriptive and accurate. Maintains consistent persuasive tone throughout letter.	Adequate choice of words that are descriptive. Demonstrates a persuasive tone in parts of the letter.	Choice of some words that are descriptive. Lacks consistent persuasive tone.	Language and tone of letter lacks description.
Spelling	Contains no spelling errors.	Contains few errors in spelling that do not interfere with meaning.	Contains many spelling errors that interfere with meaning.	Contains many spelling errors that make the piece illegible.
Grammar	Contains no grammatical errors.	Contains few errors in grammar that do not interfere with meaning.	Contains many grammatical errors that interfere with meaning.	Contains many grammatical errors that make the piece illegible.

APPENDIX E

Persuasive Writing Graphic Organizers

Paper-based Graphic Organizer

Digital Graphic Organizer
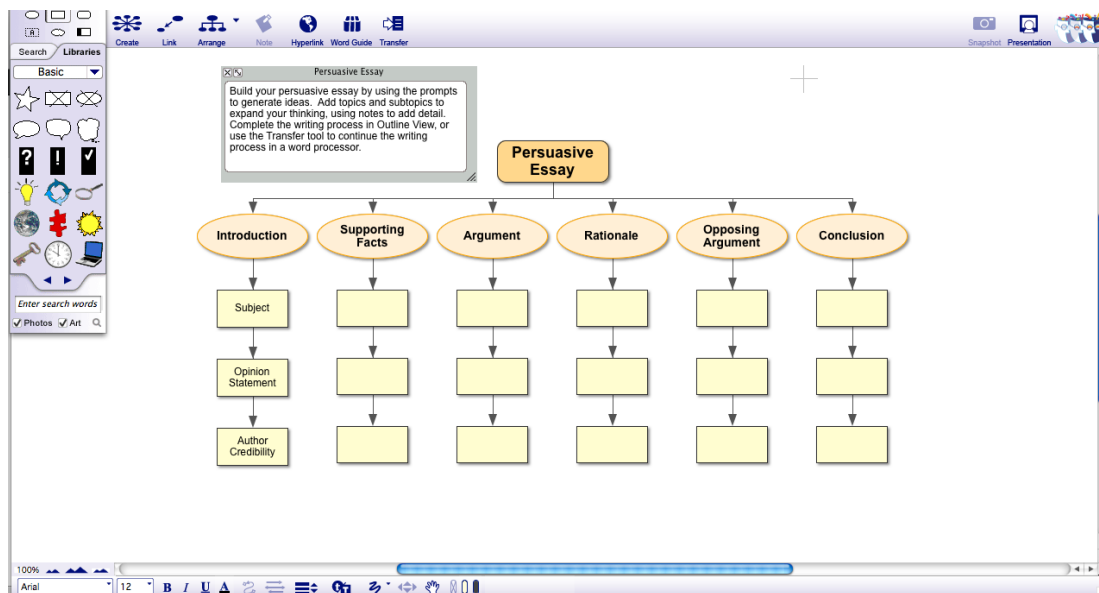
APPENDIX F

Transfer of Ideas by Students

Post-tests	Reasoning Statements by Student Transferred to Essay	Supporting Arguments by Student Transferred to Essay
Post-test 1Digital First/PS (n=36)	36	36
Pots-test 1 Paper First/DS (n=31)	31	31
Post-test 2 Digital First/PS (n=35)	34*	34*
Post-test 2 Paper First/DS (n=30)	30	30

*Student completed the entire essay but did not transfer the exact same three reasoning statements and coordinating supporting arguments over to the final essay.

APPENDIX G

Treatment Fidelity Procedures and Checklist

Observed by: _____   Date: _____

Check each item once the procedure has been fully completed. Please make a note of all behaviors skipped or altered. VERBAL indicates text the teacher should say.

Persuasive Writing Lesson Instructions

☐ Verbal - In today's lesson you will learn about persuasive writing and the different components of a persuasive writing essay. The lesson today will focus on how best to approach a topic in which you will need to persuade the reader to do something.

☐ Provide each student with a copy of the Persuasion Map Planning Sheet.

☐ Verbal - We will discuss each component on the planning sheet so that you understand what you will need to address when you start planning to persuade someone.

Goal or Thesis - A goal or thesis is a statement that describes one side of an arguable viewpoint. What is the thesis or point you are trying to argue?

Main Reasons - You will need some good reasons to support your goal or thesis. Briefly state three main reasons that would convince someone that your thesis is valid.

Facts or Examples -What are some facts or examples you could state to support each reason and validate this argument?

Conclusion - A piece of persuasive writing usually ends by summarizing the most important details of the argument and stating once again what the reader is to believe or do.

☐ After students have been introduced to the Persuasion Map Planning Sheet, share the Persuasive Letter Rubric so they understand the target for the project and what is expected of them.

☐ Teacher will pass out a copy of the scoring rubric.

☐ Verbal - The scoring rubric is a document that you can use to make sure you addressed all the components of the assignment. I will use the scoring rubric to identify a grade for you based on whether or not you included all the components of the persuasive writing essay based on the scoring rubric.

☐ Teacher will explain each rubric score and item.

☐ Teacher will introduce the mnemonic STOP and DARE and point to a handout that explains each step of STOP and DARE. Students will be provided with copies.

☐ Verbal - DARE - This is a four-step essay-writing process that will help you "D" develop a topic sentence, "A" add supporting ideas, "R" reject at least one argument for the other side and support your opinion, and "E" end with a conclusion. In the lesson today, you will be asked to use a graphic organizer. During that time, please refer to the poster on DARE and use this as you plan your persuasive essay.

☐ Verbal - STOP – Is a four-step planning process that will ask you to "S" suspend judgment that you may have, "T" take a side, "O" start organizing your ideas, and "P" plan more while you write. Once you have completed your graphic organizer, you will be ready to write a persuasive essay. As you write, refer to the poster on the wall and use this as you begin writing.

☐ Follow each step of the lesson plan that will lead to the writing prompt.

Training for Digital-Based Graphic Organizers (for researcher)

☐ Ask students to open Inspiration™ software to the persuasive writing template

☐ First demonstrate how to create a main cluster and add text. Also demonstrate how to add adjoining links. Watch and observe students as they complete the task.

☐ Demonstrate how to modify the clusters using different font sizes and colors. Watch and observe students as they complete the task.

☐ Demonstrate how to modify the clusters using different shapes and graphics. Watch and observe students as they complete the task.

☐ Demonstrate how to add hyperlinks. Watch and observe students as they complete the task.

☐ Demonstrate how to check spelling and grammar. Watch and observe students as they complete the task. Watch and observe students as they complete the task.

☐ Demonstrate how to add an audio file. Watch and observe students as they complete the task.

☐ Demonstrate how to add a video file. Watch and observe students as they complete the task.

☐ Demonstrate how to save the organizer. Watch and observe students as they complete the task.

☐ Demonstrate how to print the organizer. Watch and observe students as they complete the task.

Training for Paper-Based Graphic Organizers (for researcher)

☐ Ask students to pull out a copy of the paper-based graphic organizer.

☐ Demonstrate how to place text create a main cluster and how and where to add text in adjoining organizer boxes. Watch and observe students as they complete the task.

☐ Demonstrate where students can add references to the Internet on the paper-based graphic organizer. Watch and observe students as they complete the task.

☐ Demonstrate how to check spelling and grammar using a dictionary. Watch and observe students as they complete the task. Watch and observe students as they complete the task.

☐ Demonstrate how to make a reference to an audio clip. Watch and observe students as they complete the task.

☐ Demonstrate how to make a reference to a video file. Watch and observe students as they complete the task.

Other/Comments_____

_____

_____

_____

APPENDIX H

Student Interview Data Log

Student Identifier: **Classroom Teacher:**
Date: **Group:**
Group:
Other:

Some writers have trouble coming up with ideas for essays and others do not. On a scale from 1-5, how difficult or easy was it for you to come up with ideas for the following items below when writing your persuasive essay?					
Goal statements	1 very difficult	2 somewhat difficult	3 n/a	4 not very difficult	5 not at all difficult
Reasoning statements	1 very difficult	2 somewhat difficult	3 n/a	4 not very difficult	5 not at all difficult
Supporting arguments	1 very difficult	2 somewhat difficult	3 n/a	4 not very difficult	5 not at all difficult
Conclusion statements	1 very difficult	2 somewhat difficult	3 n/a	4 not very difficult	5 not at all difficult
Persuasive words	1 very difficult	2 somewhat difficult	3 n/a	4 not very difficult	5 not at all difficult
Ideas for your essay	1 very difficult	2 somewhat difficult	3 n/a	4 not very difficult	5 not at all difficult
On a scale from 1-5, how difficult or easy was it for you to do the following action as you wrote your persuasive essay?					
Check for spelling errors	1 very difficult	2 somewhat difficult	3 n/a	4 not very difficult	5 not at all difficult

Question	Response
1. When you wrote the essay, what strategies or methods did you use to develop details and examples for each main idea?	
2. When you wrote the essay, what strategies or methods did you use to organize your ideas?	

Question	Response
3. What aspects of your writing would you like to improve?	
4. When is writing easy for you, and what are some of the easier things about writing?	
5. When is writing difficult for you, and what are some of the difficult things about writing?	
6. How do you think learning and using digital graphic organizers helped you? Explain.	
7. How do you think using digital graphic organizers hindered you? Explain.	
8. As you wrote the essay, what strategies or methods did you use to develop your goal (personal opinion), reasoning statements, and supporting arguments?	
9. When you wrote your essay, what strategies or methods did you use to assist you as you came up with ideas for writing the final essay?	
10. As you look at the various items on the scoring rubric (goal, reasoning statements, supporting arguments, spelling, word choices, and conclusion), did the graphic organizer help you? If yes, how?	
11. Can you tell me about your learning processes, or what helped you as you completed this assignment?	

APPENDIX I

Evaluator Scoring Sheet

Goal/Thesis	Strongly and clearly states a personal opinion.	There is one goal or thesis statement that states a personal opinion.	There is one goal and it does not clearly state a personal opinion.	Personal opinion is missing.	
Reasoning Statements	Three or more excellent points are made. It is evident the writer put much thought and research into this assignment.	Three points are made.	Two points are made with weak arguments.	One point is made.	
Supporting Arguments	Well-researched supporting arguments are made for three or more reasons. The author does an excellent job of persuading.	Good, but weak in some places, arguments are made for three reasons. The writer doesn't persuade completely.	Weak arguments are made for one - two reasons. The writer doesn't persuade the reader.	Arguments are missing.	
Conclusion Statements	Summarizes personal opinion in a strong concluding statement.	Summarizes personal opinion in a concluding statement.	Concluding statement is a weak summary of personal opinion.	Concluding statement makes no reference to personal opinion.	
Organization	Paragraphs are complete, well written and varied.	Paragraph structure is generally correct.	Paragraph structure is inconsistent.	Little or no evidence of paragraph structure.	
Tone	Choice of words descriptive and accurate. Maintains consistent persuasive tone throughout letter.	Adequate choice of words that are descriptive. Demonstrates a persuasive tone in parts of the letter.	Choice of some words that are descriptive. Lacks consistent persuasive tone.	Language and tone of letter lacks description.	
Spelling/Grammar (*scored separately*)	Contains no spelling/grammar errors.	Contains few errors in spelling/grammar that do not interfere with meaning.	Contains many spelling/grammar errors that interfere with meaning.	Contains many spelling/grammar errors that make the piece illegible.	

APPENDIX J

Pre- and Post-test 1: All Outcomes

Descriptive Statistics for pre- to post-test 1 scores of students that used Digital First/PS (n=31) and Paper First/DS (n=30) across all outcomes

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Goal Statements								
DF/PS	2.97	.18	3.23	.62	-2.50	30	.02*	1.44
PF/DS	2.93	.52	3.13	.43	-1.65	29	.11	0.38
Reasoning Statements								
DF/PS	2.13	.76	2.52	.77	-2.34	30	.03*	0.51
PF/DS	2.07	.78	2.27	.87	-.97	29	.34	0.26
Supporting Arguments								
DF/PS	2.07	.68	2.42	.62	-2.62	30	.01*	0.51
PF/DS	1.93	.69	2.47	.73	-3.00	29	.005*	0.78
Conclusion Statements								
DF/PS	1.19	.48	2.19	1.01	-5.39	30	<0.001*	2.08
PF/DS	1.43	.82	2.00	.95	-2.81	29	.009*	0.70
Organization								
DF/PS	2.29	.78	2.68	.94	-2.44	30	.02*	0.50
PF/DS	2.30	.65	2.83	.87	-3.76	29	.001*	0.82
Tone								
DF/PS	1.74	.63	2.32	.75	-4.23	30	<0.001*	0.92
PF/DS	1.73	.78	2.23	.73	-3.04	29	.005*	0.64
Spelling								
DF/PS	3.39	.62	3.58	.50	-1.79	30	.08	0.32
PF/DS	3.37	.49	3.37	.56	.00	29	1.00	0.00
Grammar								
DF/PS	3.07	.44	3.16	.45	-1.14	30	.26	0.20
PF/DS	3.10	.40	3.10	.40	.00	29	1.00	0.00
Overall Scores								
DF/PS	18.84	2.73	22.10	3.95	-5.56	30	<0.001*	1.19
PF/DS	18.87	3.48	21.40	4.01	-3.25	29	.003*	0.73

Note: *significant p < 0.05

APPENDIX K

Pre- and Post-test 1 by Age: All Outcomes

Descriptive Statistics for pre- to post-test 1 scores of students aged 8-9 that used Digital First/PS (n=13) and Paper First/DS (n=17), and aged 10-11 that used Digital First/PS (n=17) and Paper First/DS (n=13) across all outcomes

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Ages 8-9								
Goal Statements								
DF/PS	3.00	.00	3.15	.69	-.81	12	.47	n/a
PF/DS	3.12	.33	3.00	.35	1.00	16	.33	-0.34
Ages 10-11								
Goal Statements								
DF/PS	2.94	.24	3.29	.59	-2.95	16	.01*	1.46
PF/DS	2.69	.63	3.31	.48	-3.41	12	.01*	0.98
Ages 8-9								
Reasoning Statements								
DF/PS	2.00	.58	2.23	.93	-.762	12	.46	0.40
PF/DS	2.35	.70	2.06	.83	1.23	16	.24	-0.41
Ages 10-11								
Reasoning Statements								
DF/PS	2.18	.88	2.71	.59	-2.73	16	.02*	0.60
PF/DS	1.69	.75	2.54	.88	-3.09	12	.01*	1.13

Scale	M Pre-test	SD	Post-test 1	M SD	t	df	p	Glass' delta
Ages 8-9								
Supporting Arguments								
DF/PS	1.92	.64	2.23	.44	-1.48	12	.17	0.48
PF/DS	2.18	.64	2.41	.62	-1.07	16	.30	0.36
Ages 10-11								
Supporting Arguments								
DF/PS	2.12	.70	2.59	.71	-2.70	16	.02*	0.67
PF/DS	1.62	.65	2.54	.88	-3.49	12	.004*	1.42
Ages 8-9								
Conclusion Statements								
DF/PS	1.08	.28	2.00	.91	-3.86	12	.002*	3.29
PF/DS	1.53	.87	1.82	.88	-1.10	16	.29	0.33
Ages 10-11								
Conclusion Statements								
DF/PS	1.29	.59	2.41	1.06	-3.95	16	.001*	1.90
PF/DS	1.31	.75	2.23	1.01	-3.21	12	.01*	1.23
Ages 8-9								
Organization								
DF/PS	2.54	.66	2.77	.60	-1.00	12	.34	0.35
PF/DS	2.29	.59	2.65	.79	-2.07	16	.06	0.61
Ages 10-11								
Organization								
DF/PS	2.06	.83	2.59	1.18	-2.31	16	.03*	0.64
PF/DS	2.31	.75	3.08	.95	-3.33	12	.006*	1.03
Ages 8-9								
Tone								
DF/PS	1.69	.63	2.23	.74	-2.50	12	.03*	0.86
PF/DS	1.82	.73	2.12	.78	-1.23	16	.24	0.41

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Ages 10-11								
Tone								
DF/PS	1.77	.66	2.35	.79	-3.05	16	.008*	0.88
PF/DS	1.62	.87	2.39	.65	-3.83	12	.002*	0.89
Ages 8-9								
Spelling								
DF/PS	3.39	.65	3.46	.52	-.43	12	.67	0.11
PF/DS	3.24	.44	3.29	.59	-.44	16	.67	0.11
Ages 10-11								
Spelling								
DF/PS	3.41	.62	3.65	.49	-1.73	16	.10	0.39
PF/DS	3.54	.52	3.46	.52	.56	12	.58	-0.15
Ages 8-9								
Grammar								
DF/PS	3.08	.49	3.15	.38	-.56	12	.58	0.14
PF/DS	3.12	.33	3.06	.43	.44	16	.67	-0.18
Ages 10-11								
Grammar								
DF/PS	3.06	.43	3.18	.53	-1.00	16	.33	0.28
PF/DS	3.08	.49	3.15	.38	-.43	12	.67	0.14
Ages 8-9								
Overall Scores								
DF/PS	18.69	2.39	21.23	3.32	-2.79	12	.02*	1.06
PF/DS	19.65	3.24	20.41	3.62	-.77	16	.46	0.23
Ages 10-11								
Overall Scores								
DF/PS	18.82	3.07	22.77	4.47	-4.97	16	<0.001*	1.29
PF/DS	17.85	3.65	22.69	4.25	-5.24	12	<0.001*	1.33

Note: n/a= no variance in the outcome on the pre-test for that group and so effect size was not reported.
*significant p < 0.05

APPENDIX L

Pre- and Post-test 1 by Gender: All Outcomes

Descriptive Statistics for pre- to post-test 1 scores of females (n=17) that used Digital First/PS and Paper First/DS (n=17) and males that used Digital First/PS (n=13) and Paper First/DS (n=13) across all outcomes

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Female								
Goal Statements								
DF/PS	3.00	.000	3.35	.61	-2.40	16	.03*	n/a
PF/DS	3.00	.000	3.18	.53	-1.38	16	.19	n/a
Male								
Goal Statements								
DF/PS	2.92	.28	3.08	.64	-1.00	12	.34	0.57
PF/DS	2.85	.80	3.08	.28	-1.00	12	.34	0.29
Female								
Reasoning Statements								
DF/PS	2.24	.75	2.82	.73	-2.42	16	.03*	0.77
PF/DS	1.94	.66	2.35	.93	-1.44	16	.17	0.62
Male								
Reasoning Statements								
DF/PS	1.92	.76	2.08	.64	-.69	12	.50	0.21
PF/DS	2.23	.93	2.15	.80	.27	12	.79	-0.09

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Female								
Supporting Arguments								
DF/PS	2.24	.66	2.77	.56	-2.73	16	.02*	0.80
PF/DS	1.82	.64	2.53	.72	-2.78	16	.01*	1.11
Male								
Supporting Arguments								
DF/PS	1.77	.60	2.00	.41	-1.39	12	.19	0.38
PF/DS	2.08	.76	2.39	.77	-1.30	12	.22	0.41
Female								
Conclusion Statements								
DF/PS	1.29	.59	2.65	1.00	-5.00	16	<0.001*	2.31
PF/DS	1.41	.87	2.00	.87	-1.90	16	.08	0.68
Male								
Conclusion Statements								
DF/PS	1.08	.28	1.69	.75	-2.89	12	.01*	2.18
PF/DS	1.46	.78	2.00	1.08	-2.21	12	.05	0.69
Female								
Organization								
DF/PS	2.29	.77	2.94	.90	-3.10	16	.007*	0.84
PF/DS	2.29	.69	2.82	.95	-2.50	16	.02*	0.77
Male								
Organization								
DF/PS	2.23	.83	2.31	.95	-.32	12	.75	0.10
PF/DS	2.31	.63	2.85	.80	-2.94	12	.01*	0.86

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Female								
Tone								
DF/PS	2.00	.61	2.53	.87	-2.73	16	.02*	0.87
PF/DS	1.59	.80	2.35	.70	-3.49	16	.003*	0.95
Male								
Tone								
DF/PS	1.39	.51	2.00	.41	-2.89	12	.01*	1.20
PF/DS	1.92	.76	2.08	.76	-.69	12	.50	0.21
Female								
Spelling								
DF/PS	3.53	.51	3.65	.49	-.81	16	.43	0.24
PF/DS	3.24	.44	3.35	.61	-.81	16	.43	0.25
Male								
Spelling								
DF/PS	3.23	.73	3.46	.52	-1.39	12	.19	0.32
PF/DS	3.54	.52	3.39	.51	1.48	12	.17	-0.29
Grammar								
DF/PS	3.24	.44	3.29	.47	-.44	16	.67	0.11
PF/DS	3.00	.000	3.18	.53	-1.38	16	.19	n/a
Male								
Grammar								
DF/PS	2.85	.38	3.00	.41	-1.48	12	.17	0.39
PF/DS	3.23	.60	3.00	.000	1.39	12	.19	-0.38

Scale	M Pre-test	SD	M Post-test 1	SD	t	df	p	Glass' delta
Female								
Overall Scores								
DF/PS	19.82	2.38	24.00	4.14	-4.84	16	<0.001*	1.21
PF/DS	18.29	3.06	21.77	4.24	-3.09	16	.007	1.14
Male								
Overall Scores								
DF/PS	17.39	2.66	19.62	2.10	-3.03	12	.01	0.84
PF/DS	19.62	3.96	20.93	3.80	1.48	12	.17	0.33

Note: n/a= no variance in the outcome on the pre-test for that group and so effect size was not reported.

*significant $p < 0.05$

APPENDIX M

Pre- and Post-test 2: All Outcomes

Descriptive Statistics for pre- to post-test 2 scores of students with Recent Paper use/Prior Digital use (n=30) and Recent Digital use/Prior Paper use (n=30) across all outcomes

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Goal Statements								
RPU/PDU	2.93	.52	2.97	.67	-.20	29	.85	0.08
RDU/PPU	2.97	.18	3.13	.51	-1.72	29	.10	0.89
Reasoning Statements								
RPU/PDU	2.10	.80	2.53	.82	-2.54	29	.02*	0.54
RDU/PPU	2.10	.76	2.40	1.00	-1.27	29	.21	0.39
Supporting Arguments								
RPU/PDU	1.97	.72	2.40	.77	-3.07	29	.01*	0.60
RDU/PPU	2.03	.67	2.43	.97	-2.11	29	.04*	0.60
Conclusion Statements								
RPU/PDU	1.43	.82	2.17	.99	-4.25	29	<0.001*	0.90
RDU/PPU	1.20	.48	2.37	1.07	-6.73	29	<0.001*	2.44
Organization								
RPU/PDU	2.30	.65	2.70	.79	-3.53	29	.001*	0.62
RDU/PPU	2.27	.78	2.67	.99	-1.99	29	.06	0.51

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Tone								
RPU/PDU	1.73	.78	2.17	.79	-3.50	29	.002*	0.56
RDU/PPU	1.73	.64	2.20	.76	-4.47	29	.000	0.73
Spelling								
RPU/PDU	3.33	.48	3.47	.57	-1.16	29	.26	0.29
RDU/PPU	3.40	.62	3.17	.38	2.04	29	.05	-0.37
Grammar								
RPU/PDU	3.10	.40	3.17	.46	-.70	29	.49	0.18
RDU/PPU	3.07	.45	3.27	.45	-1.99	29	.06	0.44
Overall Scores								
RPU/PDU	18.90	3.50	21.57	4.24	-3.83	29	<0.001*	0.76
RDU/PPU	18.77	2.75	21.63	4.51	-4.15	29	<0.001*	1.04

Note: RPU/PDU-Recent Paper-based graphic organizer Use/Prior Digital Graphic Organizer Use; RDU/PPU-Recent Digital Graphic Organizer Use/Prior Paper-based graphic organizer Use
*significant $p < 0.05$

APPENDIX N

Pre- and Post-test 2 by Age: All Outcomes

Descriptive Statistics for pre-to post-test 2 scores of students aged 8-9 and 10-11 with recent Paper use /prior Digital use and those with recent Digital use/prior Paper use across all outcomes

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 8-9								
Goal Statements								
RPU/PDU	3.00	.00	3.08	.49	-.56	12	.58	n/a
RDU/PPU	3.12	.33	2.88	.60	1.46	16	.16	-0.73
Ages 10-11								
Goal Statements								
RPU/PDU	2.94	.24	3.18	.53	-1.73	16	.10	1.00
RDU/PPU	2.67	.65	3.08	.79	-1.24	11	.24	0.63
Ages 8-9								
Reasoning Statements								
RPU/PDU	2.00	.58	2.15	.80	-.52	12	.61	0.26
RDU/PPU	2.35	.70	2.47	.62	-.57	16	.58	0.17
Ages 10-11								
Reasoning Statements								
RPU/PDU	2.18	.88	2.59	1.12	-1.16	16	.26	0.47
RDU/PPU	1.67	.78	2.58	1.08	-3.53	11	.005*	1.17

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 8-9								
Supporting Arguments								
RPU/PDU	1.92	.64	2.23	.83	-1.00	12	.34	0.48
RDU/PPU	2.18	.64	2.29	.69	-.62	16	.54	0.17
Ages 10-11								
Supporting Arguments								
RPU/PDU	2.12	.70	2.59	1.06	-1.93	16	.07	0.67
RDU/PPU	1.58	.67	2.50	.90	-6.17	11	<0.001*	1.37
Ages 8-9								
Conclusion Statements								
RPU/PDU	1.08	.28	2.08	.95	-4.42	12	.001*	3.57
RDU/PPU	1.53	.87	2.06	1.03	-2.17	16	.05	0.61
Ages 10-11								
Conclusion Statements								
RPU/PDU	1.29	.59	2.59	1.12	-5.10	16	<0.001*	2.20
RDU/PPU	1.33	.78	2.33	.98	-4.06	11	.002*	1.28
Ages 8-9								
Organization								
RPU/PDU	2.54	.66	2.69	.85	-.56	12	.58	0.23
RDU/PPU	2.29	.59	2.65	.86	-2.40	16	.03	0.61
Ages 10-11								
Organization								
RPU/PDU	2.06	.83	2.65	1.11	-2.06	16	.06	0.71
RDU/PPU	2.25	.75	2.75	.75	-2.57	11	.03	0.67

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 8-9								
Tone								
RPU/PDU	1.69	.63	2.15	.80	-2.52	12	.03*	0.73
RDU/PPU	1.82	.73	2.18	.64	-2.07	16	.06	0.49
Ages 10-11								
Tone								
RPU/PDU	1.77	.66	2.24	.75	-3.77	16	.002*	0.71
RDU/PPU	1.58	.90	2.08	1.00	-2.57	11	.03*	0.56
Ages 8-9								
Spelling								
RPU/PDU	3.39	.65	3.23	.44	1.00	12	.34	1.29
RDU/PPU	3.24	.44	3.41	.62	-1.14	16	.27	0.39
Ages 10-11								
Spelling								
RPU/PDU	3.41	.62	3.12	.33	1.77	16	.10	-0.47
RDU/PPU	3.50	.52	3.58	.51	-.43	11	.67	0.15
Ages 8-9								
Grammar								
RPU/PDU	3.08	.49	3.23	.44	-1.00	12	.34	0.31
RDU/PPU	3.12	.33	3.12	.49	.00	16	1.00	-0.03
Ages 10-11								
Grammar								
RPU/PDU	3.06	.43	3.29	.47	-1.73	16	.10	0.53
RDU/PPU	3.08	.51	3.25	.45	-1.00	11	.34	0.33

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 8-9								
Overall Scores								
RPU/PDU	18.69	2.39	20.85	3.41	-2.33	12	.04*	0.90
RDU/PPU	19.65	3.24	21.06	4.26	-1.61	16	.13	0.44
Ages 10-11								
Overall Scores								
RPU/PDU	18.82	3.07	22.24	5.23	-3.42	16	.003*	1.11
RDU/PPU	17.67	3.75	22.17	4.47	-4.26	11	.001*	1.20

Note: n/a= no variance in the outcome on the pre-test for that group and so effect size was not reported.
Students ages 8-9 - Recent paper-based graphic organizer use/prior digital use (RPU/PDU) (n=13) and Recent digital graphic organizers use/prior paper use (n=17); Students ages 10-11 - Recent paper-based graphic organizer use/prior digital use (n=17) and Recent digital graphic organizer use/prior paper use (n=12)
*significant p < 0.05

APPENDIX O

Pre- and Post-test 2 by Gender: All Outcomes

Descriptive Statistics for pre- to post-test 2 scores of females with Recent Paper use/Prior Digital use (n=17) and Recent Digital use/Prior Paper use (n=16) and males with Recent Paper use/Prior Digital use (n=13) and Recent Digital use/Prior Paper use (n=13) across all outcomes

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Female								
Goal Statements								
RPU/PDU	3.00	.000	3.06	.56	-.44	16	.67	n/a
RDU/PPU	3.00	.000	2.88	.89	.57	15	.58	n/a
Male								
Goal Statements								
RPU/PDU	2.92	.28	3.23	.44	-2.31	12	.04*	1.11
RDU/PPU	2.85	.80	3.08	.28	-.82	12	.43	0.29
Female								
Reasoning Statements								
RPU/PDU	2.24	.75	2.59	.94	-1.19	16	.25	0.47
RDU/PPU	1.94	.68	2.69	.87	-3.50	15	.003*	1.10
Male								
Reasoning Statements								
RPU/PDU	2.15	1.07	2.15	1.07	-.59	12	.57	0.30
RDU/PPU	2.23	.93	2.31	.75	-.29	12	.78	0.09
Female								
Supporting Arguments								
RPU/PDU	2.24	.66	2.71	.92	-1.93	16	.07	0.71
RDU/PPU	1.81	.66	2.56	.81	-4.39	15	.001*	1.14
Male								
Supporting Arguments								
RPU/PDU	1.77	.60	2.08	.95	-1.00	12	.34	0.52
RDU/PPU	2.08	.76	2.15	.69	-.37	12	.72	0.09

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Female								
Conclusion Statements								
RPU/PDU	1.29	.59	2.71	1.05	-6.69	16	<0.001*	2.41
RDU/PPU	1.44	.89	2.19	1.05	-2.82	15	.01*	0.84
Male								
Conclusion Statements								
RPU/PDU	1.08	.28	1.92	.95	-3.09	12	.009*	3.00
RDU/PPU	1.46	.78	2.15	.99	-2.92	12	.01*	0.88
Female								
Organization								
RPU/PDU	2.29	.77	2.77	1.09	-1.46	16	.16	0.62
RDU/PPU	2.25	.68	2.69	.95	-2.41	16	.03*	0.65
Male								
Organization								
RPU/PDU	2.23	.83	2.54	.88	-1.48	12	.17	0.37
RDU/PPU	2.31	.63	2.69	.63	-2.74	12	.02*	0.62
Female								
Tone								
RPU/PDU	2.00	.61	2.35	.79	-2.40	16	.03*	0.57
RDU/PPU	1.56	.81	2.25	.93	-4.57	15	<0.001*	0.85
Male								
Tone								
RPU/PDU	1.39	.51	2.00	.71	-4.38	12	.001*	1.20
RDU/PPU	1.92	.76	2.00	.58	-.43	12	.67	0.11
Female								
Spelling								
RPU/PDU	3.53	.51	3.12	.33	3.35	16	.004*	-0.80
RDU/PPU	3.19	.40	3.50	.63	-1.78	15	.10	0.78
Male								
Spelling								
RPU/PDU	3.23	.73	3.23	.44	.000	12	1.00	0.0000
RDU/PPU	3.54	.52	3.46	.52	.56	12	.58	-0.15

Scale	M Pre-test	SD	M Post-test 2	SD	t	df	p	Glass' delta
Female								
Grammar								
RPU/PDU	3.24	.44	3.41	.51	-1.14	16	.27	0.39
RDU/PPU	3.00	.000	3.19	.54	-1.38	15	.19	infinity
Male								
Grammar								
Digital	2.85	.38	3.08	.28	-1.90	12	.08	0.61
RDU/PPU	3.23	.60	3.15	.38	.56	12	.58	0.0000
Female								
Overall Scores								
RPU/PDU	19.82	2.38	22.71	4.61	-3.06	16	.008	1.21
RDU/PPU	18.19	3.12	21.94	5.17	-3.61	15	.003*	1.20
Male								
Overall Scores								
RPU/PDU	17.39	2.66	20.23	4.15	-2.70	12	.02*	1.07
RDU/PPU	19.62	3.97	21.00	3.06	-1.56	12	.15	0.35

*significant p < 0.05

Note. n/a= no variance in the outcome on the pre-test for that group and so effect size was not reported.
Note. Females - Recent paper-based graphic organizer use/prior digital use (RPU/PDU) (n=17) and Recent digital graphic organizers use/prior paper use (n=16); Males - Recent paper-based graphic organizer use/prior digital use (n=13) and Recent digital graphic organizer use/prior paper use (n=13)

APPENDIX P

Post-test 1 to Post-test 2: All Outcomes

Descriptive Statistics for post-test 1 to post-test 2 scores of students that used Digital First & Recent Paper use/PDU (n=35) and Paper First & Recent Digital use/PPU (n=30) across all outcomes

Scale	M Post-test 1	SD	M Post-test 2	SD	t	df	p	Glass' delta
Goal Statements								
DF/PS	3.11	.72	3.14	.49	-.22	34	.83	0.04
PF/DS	3.13	.43	2.93	.69	1.19	29	.25	-0.47
Reasoning Statements								
DF/PS	2.46	.78	2.43	.95	.16	34	.88	-0.04
PF/DS	2.27	.87	2.50	.82	-1.19	29	.24	0.26
Supporting Arguments								
DF/PS	2.34	.68	2.37	.97	-.19	34	.85	0.04
PF/DS	2.47	.73	2.37	.76	.62	29	.54	-0.14
Conclusion Statements								
DF/PS	2.11	1.02	2.20	1.08	-.53	34	.60	0.09
PF/DS	2.00	.95	2.20	1.00	-.97	29	.34	0.21
Organization								
DF/PS	2.54	.98	2.60	1.01	-.42	34	.68	0.06
PF/DS	2.83	.87	2.70	.79	.78	29	.44	-0.15
Tone								
DF/PS	2.23	.77	2.14	.77	.77	34	.45	-0.11
PF/DS	2.23	.73	2.17	.79	.42	29	.68	-0.09

Scale	M Post-test 1	SD	M Post-test 2	SD	t	df	p	Glass delta'
Spelling								
DF/PS	3.46	.70	3.20	.41	1.95	34	.06	-0.37
PF/DS	3.40	.56	3.50	.57	-.90	29	.38	0.18
Grammar								
DF/PS	3.06	.59	3.23	.43	-1.64	34	.11	0.29
PF/DS	3.10	.40	3.17	.46	-.70	29	.49	0.17
Overall Scores								
DF/PS	21.31	4.72	21.31	4.34	.00	34	1.00	0.00
PF/DS	21.43	4.00	21.53	4.23	-.13	29	.90	0.03

Note. Digital graphic organizers first/paper graphic organizers second (DF/PS), paper graphic organizers first/digital graphic organizers second (PF/DS)
*significant $p < 0.05$

APPENDIX Q

Post-test 1 to Post-test 2 by Age: All Outcomes

Descriptive Statistics for post-test 1 to post-test 2 scores of students ages 8-9 that used Digital First & Recent Paper/PDU (n=15) and Paper First & Recent Digital/PPU (n=18) and scores of students ages 10-11 that used Digital First & Recent Paper/PDU (n-19) and Paper First & Recent Digital/PPU (n=12) across all outcomes

Scale	M Post-test 1	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 8-9								
Goal Statements								
DF & Recent Paper Use/PDU	3.07	.70	3.07	.46	.00	14	1.00	0.00
PF & Recent Digital Use/PPU	3.00	.34	2.83	.62	.90	17	.38	-0.50
Ages 10-11								
Goal Statements								
DF & Recent Paper Use/PDU	3.16	.76	3.21	.54	-.29	18	.77	0.07
PF & Recent Digital Use/PPU	3.33	.49	3.08	.79	.76	11	.46	-0.51
Ages 8-9								
Reasoning Statements								
DF & Recent Paper Use/PDU	2.27	.88	2.27	.80	.00	14	1.00	0.00
PF & Recent Digital Use/PPU	2.06	.80	2.44	.62	-1.80	17	.09	0.48
Ages 10-11								
Reasoning Statements								
DF & Recent Paper Use/PDU	2.58	.69	2.53	1.07	.24	18	.82	-0.07
PF & Recent Digital Use/PPU	2.58	.90	2.58	1.08	.00	11	1.00	0.00
Ages 8-9								
Supporting Arguments								
DF & Recent Paper Use/PDU	2.20	.56	2.27	.80	-.25	14	.81	0.13
PF & Recent Digital Use/PPU	2.39	.61	2.28	.67	.52	17	.61	-0.18

Scale	M Post-test 1	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 10-11								
Supporting Arguments								
DF & Recent Paper Use/PDU	2.47	.77	2.42	1.12	.29	18	.77	-0.06
PF/DS	2.58	.90	2.50	.90	.32	11	.75	-0.09
Ages 8-9								
Conclusion Statements								
DF & Recent Paper Use/PDU	2.00	.93	1.93	.96	.25	14	.81	-0.08
PF & Recent Digital Use/PPU	1.83	.86	2.11	.77	-1.23	17	.24	0.33
Ages 10-11								
Conclusion Statements								
DF & Recent Paper Use/PDU	2.26	1.10	2.42	1.17	-.77	18	.45	0.15
PF & Recent Digital Use/PPU	2.25	1.06	2.33	.98	-.21	11	.84	0.08
Ages 8-9								
Organization								
DF & Recent Paper Use/PDU	2.60	.74	2.60	.91	.00	14	1.00	0.00
PF & Recent Digital Use/PPU	2.67	.77	2.67	.84	.00	17	1.00	0.00
Ages 10-11								
Organization								
DF & Recent Paper Use/PDU	2.47	1.17	2.58	1.12	-.52	18	.61	0.09
PF & Recent Digital Use/PPU	3.08	1.00	2.75	.75	1.08	11	.31	-0.36
Ages 8-9								
Tone								
DF & Recent Paper Use/PDU	2.13	.74	2.07	.80	.44	14	.67	-0.08
PF & Recent Digital Use/PPU	2.11	.76	2.22	.65	-.62	17	.54	0.14
Ages 10-11								
Tone								
DF & Recent Paper Use/PDU	2.26	.81	2.16	.76	.62	18	.54	-0.12
PF & Recent Digital Use/PPU	2.42	.67	2.08	1.00	1.17	11	.27	-0.51
Ages 8-9								
Spelling								
DF & Recent Paper Use/PDU	3.33	.62	3.20	.41	1.00	14	.33	-0.21
PF & Recent Digital Use/PPU	3.33	.59	3.44	.62	-.81	17	.43	0.19

Scale	M Post-test 1	SD	M Post-test 2	SD	t	df	p	Glass' delta
Ages 10-11								
Spelling								
DF & Recent Paper Use/PDU	3.53	.77	3.21	.42	1.46	18	.16	-0.42
PF & Recent Digital Use/PPU	3.50	.52	3.58	.51	-.43	11	.67	0.15
Ages 8-9								
Grammar								
DF & Recent Paper Use/PDU	3.07	.46	3.20	.41	-1.00	14	.33	0.28
PF & Recent Digital Use/PPU	3.06	.42	3.11	.47	-.44	17	.67	0.12
Ages 10-11								
Grammar								
DF & Recent Paper Use/PDU	3.05	.71	3.26	.45	-1.29	18	.22	0.30
PF & Recent Digital Use/PPU	3.17	.39	3.25	.45	-.56	11	.59	0.21
Ages 8-9								
Overall Scores								
DF & Recent Paper Use/PDU	20.67	3.90	20.60	3.25	.08	14	.94	-0.02
PF & Recent Digital Use/PPU	20.44	3.51	21.11	4.14	-.71	17	.49	0.19
Ages 10-11								
Overall Scores								
DF & Recent Paper Use/PDU	21.79	5.44	21.79	5.15	.00	18	1.00	0.00
PF & Recent Digital Use/PPU	22.91	4.36	22.17	4.47	.52	11	.61	-0.17

Note. *Digital graphic organizers first/paper graphic organizers second (DF/PS), paper graphic organizers first/digital graphic organizers second (PF/DS)*
*significant p < 0.05

APPENDIX R

Post-test 1 to Post-test 2 by Gender: All Outcomes

Descriptive Statistics for post-test 1 to post-test 2 scores of females that used Digital First & Recent Paper/PDU (n=17) and Paper First & Recent Digital/PPU (n=16) and male students that used Digital First & Recent Paper/PDU (n=17) and Paper First & Recent Digital/PPU (n=14) across all outcomes

Scale	Post-test 1		Post-test 2		t	df	p	Glass' delta
	M	SD	M	SD				
Female								
Goal Statements								
DF & RECENT PAPER USE/PDU	3.35	.61	3.06	.56	1.57	16	.14	-0.48
PF & RECENT DIGITAL USE/PPU	3.19	.54	2.88	.89	1.05	15	.31	-0.57
Male								
Goal Statements								
DF & RECENT PAPER USE/PDU	2.88	.78	3.24	.44	-2.07	16	.06	0.46
PF & RECENT DIGITAL USE/PPU	3.07	.27	3.00	.39	.56	13	.58	-0.26
Female								
Reasoning Statements								
DF & RECENT PAPER USE/PDU	2.82	.73	2.59	.94	.89	16	.39	-0.32
PF & RECENT DIGITAL USE/PPU	2.38	.96	2.69	.87	-1.10	15	.29	0.32
Male								
Reasoning Statements								
DF & RECENT PAPER USE/PDU	2.06	.66	2.24	.97	-.68	16	.51	0.27
PF & RECENT DIGITAL USE/PPU	2.14	.77	2.29	.73	-.52	13	.61	0.19
Female								
Supporting Arguments								
DF & RECENT PAPER USE/PDU	2.77	.56	2.71	.92	.29	16	.77	-0.11
PF & RECENT DIGITAL USE/PPU	2.56	.73	2.56	.81	.000	15	1.00	0.0000
Male								
Supporting Arguments								
DF & RECENT PAPER USE/PDU	1.94	.56	2.00	.94	-.25	16	.81	0.11
PF & RECENT DIGITAL USE/PPU	2.36	.75	2.14	.66	1.00	13	.34	-0.29

Scale	Post-test 1 M	SD	Post-test 2 M	SD	t	df	p	Glass' delta
Female								
Conclusion Statements								
DF & RECENT PAPER USE/PDU	2.65	1.00	2.71	1.05	-.32	16	.75	0.06
PF & RECENT DIGITAL USE/PPU	2.00	.89	2.19	1.05	-.59	15	.57	0.21
Male								
Conclusion Statements								
DF & RECENT PAPER USE/PDU	1.65	.79	1.71	.92	-.21	16	.84	0.08
PF & RECENT DIGITAL USE/PPU	2.00	1.04	2.21	.98	-.82	13	.43	0.20
Female								
Organization								
DF & RECENT PAPER USE/PDU	2.94	.90	2.77	1.09	.77	16	.46	-0.18
PF & RECENT DIGITAL USE/PPU	2.81	.98	2.69	.95	.44	15	.67	-0.12
Male								
Organization								
DF & RECENT PAPER USE/PDU	2.12	.93	2.41	.94	-2.06	16	.06	0.31
PF & RECENT DIGITAL USE/PPU	2.86	.77	2.71	.61	.81	13	.44	-0.19
Female								
Tone								
DF & RECENT PAPER USE/PDU	2.53	.87	2.35	.79	1.14	16	.27	-0.20
PF & RECENT DIGITAL USE/PPU	2.38	.72	2.25	.93	.52	15	.61	-0.18
Male								
Tone								
DF & RECENT PAPER USE/PDU	1.88	.49	1.88	.70	.00	16	1.00	0.0000
PF & RECENT DIGITAL USE/PPU	2.07	.73	2.07	.62	.000	13	1.00	0.0000
Female								
Spelling								
DF & RECENT PAPER USE/PDU	3.65	.49	3.12	.33	4.24	16	.001*	-1.08
PF & RECENT DIGITAL USE/PPU	3.38	.62	3.50	.63	-.81	15	.43	0.19
Male								
Spelling								
DF & RECENT PAPER USE/PDU	3.24	.83	3.29	.47	-.27	16	.79	0.06
PF & RECENT DIGITAL USE/PPU	3.43	.51	3.50	.52	-.43	13	.67	0.14

Scale	Post-test 1 M	SD	Post-test 2 M	SD	t	df	p	Glass' delta
Female								
Grammar								
DF & RECENT PAPER USE/PDU	3.29	.47	3.41	.51	-.81	16	.43	0.26
PF & RECENT DIGITAL USE/PPU	3.19	.54	3.19	.54	.000	15	1.00	0.0000
Male								
Grammar								
DF & RECENT PAPER USE/PDU	2.82	.64	3.06	.24	-1.46	16	.16	0.38
PF & RECENT DIGITAL USE/PPU	3.00	.000	3.14	.36	-1.47	13	.17	n/a
Female								
Overall Scores								
DF & RECENT PAPER USE/PDU	24.00	4.14	22.71	4.61	1.60	16	.13	-0.31
PF & RECENT DIGITAL USE/PPU	21.88	4.35	21.94	5.17	-.05	15	.96	0.01
Male								
Overall Scores								
DF & RECENT PAPER USE/PDU	18.59	3.83	19.82	3.76	-1.36	16	.19	0.32
PF & RECENT DIGITAL USE/PPU	20.93	3.65	21.07	2.95	-1.78	13	.86	0.04

Note. n/a= no variance in the outcome on the pre-test for that group and so effect size was not reported.
*significant p < 0.05
Note: *digital graphic organizers first/paper graphic organizers second (DF/PS), paper graphic organizers first/digital graphic organizers second (PF/DS)*

APPENDIX S

Post-test 1 and Post-test 2: All Outcomes

Table of Means, Standard Deviations, Independent t-tests, and Effect Sizes for Group Comparisons of Pre-test Digital First/PS (n=31) vs. Paper First/DS (n=30) Group Comparisons, Post-test 1 Digital First/PS (n=36) vs. Paper First/DS (n=31) Group Comparisons, and Post-test 2 Recent Paper Use/PDU (n=35) vs. Recent Digital Use/PPU (n=30) Group Comparisons across all outcomes

Scale	Digital First/PS		Paper First/DS						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Pre-test									
Goal Statements	2.97	.18	2.93	.52	.03	.35	59	.73	.10
Reasoning Statements	2.13	.76	2.07	.78	.06	.32	59	.75	.08
Supporting Arguments	2.07	.68	1.93	.69	.13	.75	59	.46	.20
Conclusion Statements	1.19	.48	1.43	.82	.24	-1.41	59	.17	-.35
Organization	2.29	.78	2.30	.65	-.01	-.05	59	.96	-.01*
Tone	1.74	.63	1.73	.78	.01	.05	59	.96	.01*
Spelling	3.39	.62	3.37	.49	.02	.14	59	.89	.04*
Grammar	3.07	.44	3.10	.40	.04	-.33	59	.75	-.07
Overall Scores	18.84	2.73	18.87	3.48	-.03	-.04	59	.97	-.01*
Post-test 1									
Goal Statements	3.08	.73	3.13	.43	-.05	-.31	65	.76	-.08
Reasoning Statements	2.42	.81	2.26	.86	.16	.78	65	.44	.19
Supporting Arguments	2.31	.71	2.45	.72	-.15	-.83	65	.41	-.19
Conclusion Statements	2.08	1.02	2.00	.93	.08	.35	65	.73	.08
Organization	2.53	.97	2.84	.86	-.31	-1.38	65	.17	-.33
Tone	2.19	.79	2.23	.72	-.03	-.17	65	.87	-.05
Spelling	3.44	.69	3.39	.56	.06	.37	65	.71	.08
Grammar	3.06	.58	3.10	.40	-.04	-.33	65	.74	-.08
Overall Scores	21.11	4.81	21.39	3.94	-.28	-.25	65	.80	-.06

Scale	Recent Paper Use/PDU		Recent Digital Use/PPU						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Post-test 2									
Goal Statements	3.14	.49	2.93	.69	.21	1.42	63	.16	.35
Reasoning Statements	2.43	.95	2.50	.82	-.07	-.32	63	.75	-.08
Supporting Arguments	2.37	.97	2.37	.76	.00	.02	63	.98	<0.001*
Conclusion Statements	2.20	1.08	2.20	1.00	.00	.00	63	1.00	<0.001*
Organization	2.60	1.01	2.70	.79	-.10	-.44	63	.66	-.11
Tone	2.14	.77	2.17	.79	-.02	-.12	63	.90	-.04*
Spelling	3.20	.41	3.50	.57	-.30	-2.46	63	.02*	-.60
Grammar	3.23	.43	3.17	.46	.06	.56	63	.58	.13
Overall Scores	21.31	4.34	21.53	4.23	-.22	-.21	63	.84	-.05

*significant $p < 0.05$

APPENDIX T

Post-test 1 and Post-test 2 by Age: All Outcomes

Table of Means, SD, independent t-test results, and effect sizes for pre-test Digital First/PS (n=13) vs. Paper First/DS (n=17) group, post-test 1 Digital First/PS (n=16) vs. Paper First/DS (n=18) group, post-test 2 Recent Paper Use/PDU (n=15) vs. Recent Digital Use/PPU (n=18) group comparisons for students aged 8-9, pre-test Digital First/PS (n=18) vs. Paper First/DS (n=13) group, post-test 1 Digital First/PS (n=20) vs. Paper First/DS (n=13) group, post-test 2 Recent Paper Use/PDU (n=20) vs. Recent Digital Use/PPU (n=12) group for students aged 10-11 across all outcomes

Scale	Digital First/PS		Paper First/DS						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Pre-test									
Goal Statements									
Ages 8-9	3.00	.000	3.12	.33	-.12	-1.27	28	.21	-.51
Ages 10-11	2.94	.24	2.69	.63	.25	1.56	29	.13	.52
Reasoning Statements									
Ages 8-9	2.00	.58	2.35	.70	-.35	-1.47	28	.15	-.54
Ages 10-11	2.22	.88	1.69	.75	.53	1.76	29	.09	.64
Supporting Arguments									
Ages 8-9	1.92	.64	2.18	.64	-.25	-1.08	28	.29	-.40
Ages 10-11	2.17	.71	1.62	.65	.55	2.21	29	.04*	.80
Conclusion Statements									
Ages 8-9	1.08	.28	1.53	.87	-.45	-1.79	28	.08	-.69
Ages 10-11	1.28	.57	1.31	.75	-.03	-.13	29	.90	-.04
Organization									
Ages 8-9	2.54	.66	2.29	.59	.24	1.07	28	.29	.39
Ages 10-11	2.11	.83	2.31	.75	-.20	-.68	29	.51	-.25
Tone									
Ages 8-9	1.69	.63	1.82	.73	-.13	-.52	28	.61	-.19
Ages 10-11	1.78	.65	1.62	.87	.16	.60	29	.56	.21

Scale	Digital First/PS		Paper First/DS						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Spelling									
Ages 8-9	3.39	.65	3.24	.44	.75	.15	28	.46	.27
Ages 10-11	3.39	.61	3.54	.52	-72	-.15	29	.48	-.26
Grammar									
Ages 8-9	3.08	.49	3.12	.33	-.27	-.04	28	.79	-.09
Ages 10-11	3.06	.42	3.08	.49	-.13	-.02	29	.90	-.04
Overall Scores									
Ages 8-9	18.69	2.39	19.65	3.24	-.89	-.95	28	.38	-.32
Ages 10-11	18.94	3.02	17.85	3.65	.92	1.10	29	.37	.32
Post-test 1									
Goal Statements									
Ages 8-9	3.00	.73	3.00	.34	.000	.00	32	1.00	.00
Ages 10-11	3.15	.75	3.31	.48	-.68	-.16	31	.51	-.25
Reasoning Statements									
Ages 8-9	2.19	.91	2.06	.80	.45	.13	32	.66	.15
Ages 10-11	2.60	.68	2.54	.88	.23	.06	31	.82	.08
Supporting Arguments									
Ages 8-9	2.13	.62	2.39	.61	-1.25	.26	32	.22	.42
Ages 10-11	2.45	.76	2.54	.88	-.31	-.09	31	.76	-.11
Conclusion Statements									
Ages 8-9	1.94	.93	1.83	.86	.34	.10	32	.74	.12
Ages 10-11	2.20	1.11	2.23	1.01	-.08	-.03	31	.94	-.03
Organization									
Ages 8-9	2.56	.73	2.67	.77	-.41	-.10	32	.69	-.14
Ages 10-11	2.50	1.15	3.08	.95	-1.5	-.58	31	.14	-.54
Tone									
Ages 8-9	2.06	.77	2.11	.76	-.19	-.05	32	.85	-.06
Ages 10-11	2.30	.80	2.39	.65	-.32	.12	31	.75	.12

Scale	Digital First/PS Mean	SD	Paper First/DS Mean	SD	MD	t	df	p	Hedges' g
Spelling									
Ages 8-9	3.31	.60	3.33	.59	-.02	-.10	32	.92	-.03
Ages 10-11	3.55	.76	3.46	.52	-.38	.37	31	.72	.14
Grammar									
Ages 8-9	3.06	.44	3.06	.42	.01	.05	32	.96	.00
Ages 10-11	3.05	.69	3.15	.38	.00	-.50	31	.62	-.18
Overall Scores									
Ages 8-9	20.25	4.12	20.44	3.52	-.19	-.15	32	.88	-.05
Ages 10-11	21.80	5.30	22.69	4.25	-.89	-.51	31	.61	-.18

Scale	Recent Paper Use/PDU Mean	SD	Recent Digital Use/PPU Mean	SD	MD	t	df	p	Hedges' g
Post-test 2									
Goal Statements									
Ages 8-9	3.07	.46	2.83	.62	.23	1.21	31	.24	.43
Ages 10-11	3.20	.52	3.08	.79	.12	.50	30	.62	.18
Reasoning Statements									
Ages 8-9	2.27	.80	2.44	.62	-.18	-.72	31	.48	-.01
Ages 10-11	2.55	1.05	2.58	1.08	-.03	-.09	30	.93	-.03
Supporting Arguments									
Ages 8-9	2.27	.80	2.28	.67	-.01	-.04	31	.97	-.01
Ages 10-11	2.45	1.10	2.50	.90	-.05	-.13	30	.90	-.05
Conclusion Statements									
Ages 8-9	1.93	.96	2.11	1.02	-.18	-.51	31	.61	-.18
Ages 10-11	2.40	1.14	2.33	.98	.07	.17	30	.87	.07

Scale	Recent Paper Use/PDU		Recent Digital Use/PPU		MD	t	df	p	Hedges' g
	Mean	SD	Mean	SD					
Organization									
Ages 8-9	2.60	.91	2.67	.84	-.07	-.22	31	.83	-.08
Ages 10-11	2.60	1.10	2.75	.75	-.15	-.42	30	.68	-.16
Tone									
Ages 8-9	2.07	.80	2.22	.65	-.16	-.62	31	.54	-.20
Ages 10-11	2.20	.77	2.08	1.00	.12	.37	30	.71	.13
Spelling									
Ages 8-9	3.20	-.41	3.44	.62	-.24	-1.31	31	.20	-.45
Ages 10-11	3.20	.41	3.59	.51	-.38	-2.33	30	.03*	-.83
Grammar									
Ages 8-9	3.20	.41	3.11	.47	.09	.57	31	.57	.20
Ages 10-11	3.25	.44	3.25	.45	.00	.00	30	1.00	.00
Overall Scores									
Ages 8-9	20.60	3.25	21.11	4.14	-.19	-.39	31	.70	-.14
Ages 10-11	21.85	5.02	22.17	4.47	-.32	-.18	30	.86	-.07

Note. *significant p < 0.05

APPENDIX U

Post-test 1 and Post-test 2 by Gender: All Outcomes

Table of Means, SD, independent t-test results, and effect sizes for group comparisons of females pre-test Digital First/PS(n=17) vs. Paper First/DS (n=17), post-test 1 Digital First/PS (n=18) vs. Paper First/DS (n=17), post-test 2 Recent Paper Use/PDU (n-17) vs. Recent Digital Use/PPU (n=16), group comparisons of males pre-test Digital First/PS (n=14) vs. Paper First/DS (n=13), post-test 1 Digital First/PS (n=18) vs. Paper First/DS (n=14), post-test 2 Recent Paper Use/PDU (n=18) vs. Recent Digital Use/PPU (n=14) group across all outcomes

Scale	Digital First/PS		Paper First/DS						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Pre-test									
Goal Statements									
Female	3.00	.000	3.00	.00	n/a	n/a	n/a	n/a	
Male	2.93	.27	2.85	.81	.08	.36	25	.72	.13
Reasoning Statements									
Female	2.24	.75	1.94	.66	.29	1.21	32	.23	.42
Male	2.00	.78	2.23	.93	-.23	-.70	25	.49	-.26
Supporting Arguments									
Female	2.24	.66	1.84	.64	.41	1.85	32	.07	.61
Male	1.86	.66	2.08	.76	-.22	.80	25	.43	-.30
Conclusion Statements									
Female	1.29	.59	1.41	.87	-.12	-.46	32	.65	-.16
Male	1.07	.27	1.46	.78	-.39	-1.77	25	.09	-.66
Organization									
Female	2.29	.77	2.29	.69	.00	.00	32	1.00	.00
Male	2.29	.83	2.31	.63	-.02	-.08	25	.94	-.03
Tone									
Female	2.00	.61	1.59	.80	.41	1.69	32	.10	-.57
Male	1.43	.51	1.92	.76	-.49	-2.00	25	.06	-.75

Scale	Digital First/PS		Paper First/DS						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Spelling									
Female	3.53	.51	3.24	.44	.29	1.80	32	.08	.60
Male	3.21	.70	3.54	.52	-.32	-1.36	25	.19	-.53
Grammar									
Female	3.24	.44	3.00	.000	.03	2.22	32	.03*	.76
Male	2.86	.36	3.23	.60	-.37	-1.98	25	.06	-.74
Overall Scores									
Female	19.82	2.38	18.29	3.06	.11	1.63	32	.11	.55
Male	17.64	2.73	19.62	3.97	-1.97	-1.51	25	.14	-.57
Post-test 1									
Goal Statements									
Female	3.28	.67	3.18	.53	.10	.50	33	.62	.17
Male	2.89	.76	3.07	.27	-.18	-.86	30	.40	-.31
Reasoning Statements									
Female	2.72	.83	2.35	.93	.29	1.24	33	.22	.41
Male	2.11	.68	2.14	.77	-.03	-.12	30	.90	-.04
Supporting Arguments									
Female	2.67	.69	2.53	.72	.41	.58	33	.57	.20
Male	1.94	.54	2.36	.74	-.41	-1.82	30	.08	-.63
Conclusion Statements									
Female	2.56	1.04	2.00	.87	-.12	1.71	33	.10	.58
Male	1.61	.78	2.00	1.04	-.39	-1.21	30	.24	-.42
Organization									
Female	2.89	.90	2.82	.95	.07	.21	33	.84	.07
Male	2.17	.92	2.86	.77	-.69	-2.25	30	.03*	-.80
Tone									
Female	2.44	.92	2.35	.70	.41	.33	33	.74	.11
Male	1.94	.54	2.07	.73	-.13	-.57	30	.58	-.20

Scale	Digital First/PS		Paper First/DS						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Spelling									
Female	3.61	.50	3.35	.61	.29	1.38	33	.18	.46
Male	3.28	.83	3.43	.51	-.15	-.60	30	.56	-.22
Grammar									
Female	3.28	.46	3.18	.53	.23	.61	33	.55	.20
Male	2.83	.62	3.00	.00	-.17	-1.00	30	.32	-.38
Overall Scores									
Female	23.44	4.66	21.77	4.24	1.53	1.11	33	.27	.37
Male	18.78	3.80	20.93	3.65	-2.15	-1.62	30	.12	-.57

Scale	Recent Paper Use/PDU		Recent Digital Use/PPU						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Post-test 2									
Goal Statements									
Female	3.06	.56	2.88	.89	.18	.72	31	.48	.24
Male	3.22	.43	3.00	.39	.22	1.51	30	.14	.53
Reasoning Statements									
Female	2.59	.94	2.69	.87	-.10	-.31	31	.76	-.11
Male	2.28	.96	2.29	.73	-.01	-.03	30	.98	-.01
Supporting Arguments									
Female	2.71	.92	2.56	.81	.14	.47	31	.64	.17
Male	2.06	.94	2.14	.66	-.09	-.30	30	.77	-.10
Conclusion Statements									
Female	2.71	1.05	2.19	1.05	.52	1.42	31	.17	-.49
Male	1.72	.89	2.21	.98	-.49	-1.48	30	.15	-.52

Scale	Recent Paper Use/PDU		Recent Digital Use/PPU						
	Mean	SD	Mean	SD	MD	t	df	p	Hedges' g
Organization									
Female	2.77	1.09	2.69	.95	.08	.22	31	.83	.08
Male	2.44	.92	2.71	.61	-.27	-.94	30	.35	-.34
Tone									
Female	2.35	.79	2.25	.93	.10	.34	31	.73	.11
Male	1.94	.73	2.07	.62	-.13	-.52	30	.60	-.19
Spelling									
Female	3.12	.33	3.50	.63	-.38	-2.19	31	.04*	-.75
Male	3.28	.46	3.50	.52	-.22	-1.28	30	.21	-.44
Grammar									
Female	3.41	.51	3.19	.54	.22	1.23	31	.23	-.41
Male	3.06	.24	3.14	.36	-.09	-.82	30	.42	-.26
Overall Scores									
Female	22.71	4.61	21.94	5.17	.77	.45	31	.66	.16
Male	20.00	3.73	21.07	2.95	-1.07	-.88	30	.39	-.31

Note. *significant $p < 0.05$

APPENDIX V

Institutional Review Board (IRB) Approval

TOWSON
UNIVERSITY

Date: Wednesday, August 29, 2012

NOTICE OF APPROVAL

TO: Mila   Fuller   **DEPT:**   EDTL

PROJECT TITLE: *The Impact of Digital Graphic Organizers on the Persuasive Writing Process*

SPONSORING AGENCY:

APPROVAL NUMBER: 13-A002

The Institutional Review Board for the Protection of Human Participants has approved the project described above. Approval was based on the descriptive material and procedures you submitted for review. Should any changes be made in your procedures, or if you should encounter any new risks, reactions, injuries, or deaths of persons as participants, you must notify the Board.

A consent form: [✓] is [ ] is not   required of each participant

Assent: [ ] is [ ] is not   required of each participant

This protocol was first approved on: 29-Aug-2012
This research will be reviewed every year from the date of first approval.

Melissa Osborne Groves, Member
Towson University Institutional Review Board

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International Society for Technology in Education (ISTE), 2003-2008
Director of Strategic Initiatives

Notre Dame of Maryland University, 2001-2002
Associate Faculty || College of Education

Baltimore City Public School System, 1997-2003
Coordinator of Technology Leadership
Previous Positions: Education Technology Associate, Language Arts Lead
Teacher, Language Arts/Social Studies Teacher

Advisory/Executive Boards

- American Society of Association Executives, Executive Management Council
- Delta Sigma Theta Sorority, Champaign Urbana Chapter, Technology Chair
- Champaign Urbana Schools Foundation, Board Member
- International Society for Technology in Education, Board Member
- ISTE National Educational Technology Standards Refresh, Leadership Team
- Maryland Society for Educational Technology, Past President

Courses Taught

- Foundations of Teaching and Learning with Technology
- Technology for Instruction and Management

Scholarships/Awards

- ASAE Diversity Executive Leadership Program, Scholar
- Dennis E. Hinkle Memorial Scholarship
- ISTE Making "IT" Happen Award
- Maryland Technology Academy Fellow
- Towson University Graduate Student Terminal Degree Fellowship

Professional Affiliations

- American Society of Association Executives (ASAE)
- Delta Sigma Theta Sorority, Incorporated (DST)
- International Society for Technology in Education (ISTE)
- Maryland Society for Educational Technology (MSET)
- National Council of Teachers of English (NCTE)