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The Effect of Speech-to-Text Software on Learning a New Writing Strategy

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Graduate Program in Education
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Abstract

Handwriting and spelling present elementary students with significant sources of load on working memory as the various writing processes compete for cognitive resources (Kellogg, Whiteford, Turner, Cahill & Mertens, 2013). Several studies have shown that speech-to-text (STT) software can improve students' writing on a specific text (Higgins & Raskind, 1997; MacArthur & Cavalier, 2004; Quinlan, 2004); however, the question of whether STT can be used to teach writing strategies has been neglected. This pretest-post-test between groups study experimentally tested the effects of composition modality on learning a persuasive writing strategy. First, all students (N=45) completed a pretest of persuasive writing. They then, received instruction in Dragon NaturallySpeaking (version 11). Next, students were randomly assigned to participate in four lessons that emphasized dialectical elements of persuasive writing, in one of two modalities: STT or handwriting. Finally, all students completed post-tests of persuasive writing in both modalities (STT and handwriting). Writing samples were evaluated for word count, number of types of rhetorical moves, surface errors, and word errors. Students also completed measures of cognitive load for the pretest, each writing activity, and post-test. Both training conditions resulted in large, statistically significant, pre-to-post-test gains on word count, holistic quality and rhetorical moves. Students in the STT condition reported more effort compared to students in the handwriting condition for both post-tests. Students in both instructional conditions showed a high level of transfer from the trained modality to the untrained modality. Students who learned through handwriting, compared to students who learned through STT, showed more surface errors on the STT post-test. The results suggest that STT could be an equally effective alternative for teaching composition strategies.

Keywords

writing skills; assistive technology; strategy instruction; speech-to-text; persuasive writing; cognitive load.

Dedication

This thesis is dedicated to my family and friends for their continued love and support.

Acknowledgments

I would like to give special thanks to my thesis supervisor, Dr. Perry Klein, for his countless hours of support, advice and guidance throughout this process. I would also like to thank my thesis advisory committee member, Dr. Jacqueline Specht, for her input, assistance and support. I also thank my fellow colleagues, Nina Arcon and Samanta Baker, for their assistance and encouragement. Finally, a big thank you to all of the teachers and students who participated in the study and made this research possible.

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Chapter 1: Introduction and Literature Review

Introduction

Writing is a form of communication that is important not only in an educational setting, but for communication in everyday life. Students who find writing to be difficult are often struggling with the mechanics of their writing. This focus on the mechanics interferes with the composing process by consuming students' available working memory and, in turn, affects the overall quality and quantity of students' writing (Bourdin & Fayol, 1994; McCutchen, 2011). Technological advances have made it possible for many computer software programs to support students' writing (Barrera, Rule & Diemart, 2001). It is possible that this support is a result of the technology relieving the burden imposed by writing on the working memory.

Speech-to-text software (STT), which is the focus of the present study, has been around for some time; however, recent advances have made it possible for students to use STT software at school and at home as a tool to improve their writing (Nuance Communications, 2014). Although research has confirmed that this technology aids students in writing a particular text (Garrett, Heller, Fowler, Alberto, Fredrick & O'Rourke, 2011; Millar, McNaughton, & Light, 2005), researchers have not yet investigated the effects of using STT technology to facilitate learning a new writing genre. In particular, STT technology is recommended to help students write but its effects on learning to write are unknown. The present study sought to examine if the use of STT software, specifically Dragon NaturallySpeaking Version 11, would facilitate learning persuasive writing, in comparison to the traditional handwritten method of composition. It also investigated whether this strategy transferred learned skills between the STT and handwritten modalities.

The Cognitive Psychology of Writing

Writing is a demanding task due to the many cognitive processes involved, such as planning, translating and reviewing. Because these processes are not automated in every writer, they demand a great deal of attention (Flower & Hayes, 1981). The role of working memory in sub-processes of writing is explained using the cognitive process model. This model includes three main components: (a) the task environment that describes the rhetorical problem and the text to be produced; (b) the writing processes that include planning, translating and reviewing; and (c) the long term memory, which is comprised of the writer's knowledge (Flower & Hayes, 1981; Hayes, 2012). The three writing processes (planning, translating and reviewing) are not discrete; that is, they are always interrupting each other. The present study addressed the planning and translation phases of the writing process with the use of prompts and the STT software, Dragon NaturallySpeaking.

The Flower and Hayes (1981) cognitive process model was updated by Berninger and colleagues (Cartwright, Yates, Swanson & Abbott), to include children and beginning writers. Another addition to the cognitive process model was transcription, which they defined as spelling and handwriting processes. The beginning writer's transcription is not automatic, so it competes for cognitive resources with higher order processes during the planning, revising, and text generation phases of composition (Berninger, Cartwright, Yates, Swanson & Abbott, 1994; Berninger, Vaughn, Abbott, Rogan, Brooks, Reed & Graham, 1997; Koutsoftas & Gray, 2013).

Berninger, Vaughn, Abbott, Rogan, Brooks, Reed and Graham (1997) conducted a series of experiments to investigate transcription in the form of handwriting. The researchers theorized that learning to write is a system that draws from multiple cognitive processes, some of which

are low level and some are high level. The goal was to automatize handwriting, which is a low-level process. This automaticity would allow for greater working memory capacity. The results indicated that there was transfer from handwriting to compositional fluency and thus from transcription to text generation. This provided evidence that transcription plays a causal role in constraining composition.

Each of the processes involved in writing draws from working memory and competes for cognitive resources in both adults and children (Kellogg et al., 2013; McCutchen, 2011). For children, it has been shown that they typically have difficulty with writing, partially because the processes involved are not yet automatized. However, these difficulties could extend to adults as well. Transcription is typically more fluent for adults, and it has been theorized that as transcription becomes more fluent it decreases working memory demands; this results in texts that are of better quality (McCutchen, 2011). Working memory also effects text generation; this is defined by Flower and Hayes (1981) in the cognitive process model as translation, which is the way in which a writer thinks about the linguistic message they want to convey. Working memory constraints during text generation can become more challenging when students are trying to negotiate semantics necessary for composing. All of these sources of knowledge are coordinated and used simultaneously but they are all limited by the working memory's capacity.

Berninger, Cartwright, Yates, Swanson and Abbott (1994) conducted a series of experiments to investigate working memory, cognitive load and writing. In one experiment, students between grades 4 and 6 produced written compositions under a time constraint. The hypothesis was that children who were able to produce the composition quickly and correctly had automaticity of lower level processes (i.e., transcription). This automaticity of basic processes allowed for greater working memory capacity to be dedicated to composing. The

results indicated that the central executive (a process within working memory) was related to the skills used for idea generation and translation in writing. Similarly, Vanderberg and Swanson (2007) conducted an empirical study that looked to measure planning, text production (i.e., transcription and translation) and revision separately. Their findings suggested that available working memory predicts the translation and transcription components of writing. When instructional practices are aimed at improving transcription for beginner or unskilled writers it could transfer to improved texts (Berninger et al., 1997; Graham, Harris & Fink, 2000; Vanderberg & Swanson, 2007). In conclusion, planning and transcription compete for working memory resources. The present study extended this research through use of STT technology as the method to accommodate for the demands of transcription on working memory; this was to allow the student to devote more resources to planning.

Based on the information that is known about the writing process, particularly the competition of transcription with idea generation and genre structuration for working memory resources, it was hypothesized that STT software would assist students in learning to write a new genre and reduce the cognitive load that arises from handwriting and spelling. For the present study it was theorized that this additional available working memory would assist with learning the new genre.

Dictation and Speech-to-text Technology Facilitate Composition

Given the rationale that for children and struggling writers, oral composition through STT may reduce cognitive load, it is imperative to discuss research on dictation as a mode of composition. Dictation to a scribe is analogous to STT software and is still used within educational institutions to assist students who struggle with writing and who have typically been

identified as having a learning or physical disability. Dictation allows thinking to unfold in a natural and uninterrupted way. It is thought that this process alleviates the burden that transcription places on working memory and allows the student to focus on the content of their composition, increasing students' rate of writing and text length (De La Paz & Graham, 1997; Hayes & Berninger, 2009; MacArthur & Cavalier, 2004; MacArthur & Graham, 1987). Dictation to a scribe also has its limitations; it is time consuming and costly to have a human transcriber on hand. Additionally, dictation to a scribe does not allow the student freedom or independence to work on their own.

In a research study by De La Paz and Graham (1997), the effects of dictation versus handwriting combined with instruction strategies for advanced planning on student's persuasive essays was examined. All students were identified as having learning disabilities or difficulty writing. Students were assigned to one of two groups. The first group was taught a strategy for advanced planning; and the second was a comparison group that was not taught the strategy for advanced planning. These groups were then each divided in half. Half of the students used dictation and the others wrote with pen and paper. The students using dictation were required to dictate both their plan and their final text. It was found that dictation alone improved the quality ratings of those students who originally had the lowest quality essays at the pretest. A combination of instruction and dictation had a significantly greater effect on students writing in that compositions were more complete and qualitatively rated as better. This research study is significant for the present study, in that it demonstrates that using dictation to alleviate the demands of transcription is not only sufficient to elicit good composition; it is also necessary to support students in creating text structure.

Speech-to-text technology (STT), also known as voice recognition software or speech recognition software, is a type of computer program that allows a user to compose written text through dictation to a computer or other device (De La Paz, 1999; Nuance Communications, 2014). Originally, STT programs were only able to use discrete speech recognition; this required the user to say one word at a time to the computer. This process was lengthy and frustrating. Fortunately, the software has since evolved to use continuous speech recognition (Higgins & Raskind, 2000). With continuous speech recognition, users can speak as if they are having a natural conversation, much like dictation to a scribe. In addition, the use of the technology (instead of the human scribe) allows the writer independence and the ability to see and revise their text as it is composed (Higgins & Raskind, 2000; MacArthur & Cavalier, 2004). STT technology was chosen as the focus of this research over other assistive technologies in writing because the replacement of handwriting and spelling with dictation is hypothesized to offload the demands of the writing process on working memory.

A study conducted by Higgins and Raskind (1997) investigated the effects of STT with children with learning disabilities. At the time, they were using the very first version of Dragon NaturallySpeaking (v. 1). Students were randomly assigned to the STT condition, and results were measured using a pretest-post-test design. Students were taught how to use Dragon NaturallySpeaking, and completed training sessions to familiarize themselves with the software. Students selected their own writing topics in order to increase their motivation to compose. Researchers concluded that the STT intervention was successful in improving word recognition and reading comprehension. The present study furthered this research in using an updated version of the software (v. 11) and focusing on the software's effects on learning to write with students of all abilities in fifth grade. Since this study was conducted, Dragon NaturallySpeaking

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has come a long way in improving its software through continuous speech recognition and improved accuracy (Nuance Communications, 2014).

MacArthur and Cavalier (2004) investigated the use of dictation as an accommodation using two modalities: dictation to a scribe and dictation to STT (Dragon NaturallySpeaking Version 4). Participants included 31 high school students with and without learning disabilities. The students were provided with a series of writing prompts in all conditions. In the dictation condition, the scribe simulated STT software by writing out the text so that it was visible to the student. For students without learning disabilities, the quality of their essays remained constant across the three conditions (handwriting, scribe and technology). However, it was found that both dictation to a scribe and dictation to Dragon NaturallySpeaking helped students with learning disabilities to produce better quality essays. In an interview conducted after the study, MacArthur and Cavalier reported the following reasons that students did not like using the software: Mistakes in word recognition, difficulty in correcting errors and difficulty initially training the system. Since this study was conducted, Dragon NaturallySpeaking has grown to version 11 (at the outset of the current study) and version 13 (at the time of publication). It is possible that students in MacArthur and Cavalier's (2004) research had difficulty using this earlier version of the software and the updated accuracy of later software could produce different results. This research, while important, aimed at facilitating a specific piece of writing. The present study differed in that it focused on learning a new writing strategy with the support of STT technology.

In subsequent research, the use of STT technology again showed positive effects in improving students' writing. Quinlan (2004) focused on fluent versus less fluent writer's narrative compositions. The researcher compared traditional handwriting and the STT software Dragon

NaturallySpeaking (Version 5). Participants were students aged 11 through 14 who met criteria as either fluent or less fluent writers. The less fluent writers demonstrated a discrepancy between their oral and written language. It was found that fluent writers composed longer texts and that the effect of writing mode was significant for less fluent writers only; their STT narratives were significantly longer (Quinlan, 2004). In addition, for less fluent writers narratives composed with STT had significantly fewer surface errors. In general, students who saw the most improvement when using STT were those with learning or physical disabilities who were identified as less fluent writers (Quinlan, 2004). The authors explained the results by proposing that STT technology freed working memory resources by reducing transcription related interference, but they did not collect empirical data on this variable.

Possible Application of STT to Strategy Instruction

The majority of research that has examined writing and technology, specifically STT, has only examined short-term benefits for student's compositions. That is, most research has looked at performance on the specific piece of writing being composed (Higgins & Raskind, 1995; MacArthur & Cavalier, 2004; Quinlan, 2004). However, a further question is how it might play a role in learning to write. Transcription and learning to write both draw on working memory (Kellogg et al., 2013; McCutchen, 2011). This suggests that if STT could be used to reduce the work of transcribing, then it could facilitate learning to compose.

The present study proposed to investigate whether STT can help students learn to write a new writing strategy. Strategy instruction is the most heavily researched method of teaching writing and teaching students to plan and organize their writing. In a recent meta-analysis by Graham, McKeown, Kiuahara & Harris (2012), writing strategies were examined and strategy

instruction was found to be used mostly in teaching genre specific writing strategies such as persuasive or argument writing. All of the studies in the meta-analysis found that strategy instruction enhanced the quality of written compositions; they all had a positive effect with a statistically significant average (Graham et al., 2012). The present study used strategy instruction to introduce participants to persuasive writing.

The goal of a persuasive piece is to change the opinion of the reader or cause them to rethink an issue (Barone, 2011; Nippold, Ward-Lonergan, & Fanning, 2005). For children, this writing strategy can be especially difficult because they have to think about many different components. In order to write a persuasive text correctly, students must include the following elements: support a particular point of view, provide reasons and evidence for those reasons, and consider the opposing position, reasons for that position, a rebuttal and conclusion (Barone, 2011; Nippold et al., 2005). Persuasive writing was chosen for the present study due to its difficult nature and importance in the curriculum. In addition, developing an argument for both sides of an issue can increase critical thinking and learning about a topic (Klein & Rose, 2010).

Students, who are competent or exceptional writers, as well as low-achieving writers, often struggle with this genre. As a result, students tend to write one-sided arguments (Ferretti, Lewis & Andrews-Weckerly, 2009; Nippold et al., 2005). Ferretti, Lewis and Andrews-Weckerly (2009) investigated whether genre specific sub-goals and a general goal to persuade the reader would affect the structure and strategies used by students in their argument writing. There were two groups, the control group, which was given the general goal, and the experimental group, which was provided with a prompt that reminded students of the components of a persuasive argument (elaborated goal). The results indicated that students in the elaborated goal condition had more reasons to support their opinion and they reported alternative

opinions. However, the arguments for the alternative opinions were not as well developed as the arguments for their own opinions. Despite this, the overall conclusion was that students of all ages and abilities would benefit from sub-goals for persuasive writing.

The Present Study

The present study was developed based on the theory that STT, in this case Dragon NaturallySpeaking, could be used to replace transcription. In effect, this would remove the burden that transcription places on working memory, and allow students to focus attention on learning a new writing strategy. Additionally, in using the STT technology for composition it was hypothesized students would have fewer spelling errors, more types of argument moves and a higher text quality.

The study was a pretest-post-test randomized experiment. First, all students completed a pretest of argument writing. They were randomly assigned to STT or handwriting condition. All participants had the opportunity to learn how to use the STT software. They were then taught a series of lessons on persuasive writing. Each lesson focused on a sub-goal of persuasive writing. Following completion of the lessons, students were given two post-tests, one handwritten and one using STT.

This research addressed the question: Does the use of STT technology facilitate learning of persuasive writing when compared to handwriting. It was hypothesized that (1) both instructional modalities would produce learning gains from pretest to written post-test; (2) both instructional modalities would produce learning gains from pretest to STT post-test; (3) STT instruction would have a greater effect than written instruction on learning gains from pretest to post-tests, and (4) that there would be transfer of learning between modalities.

Chapter 2: Method

Design Overview

The study was a between-subjects, randomized pretest-post-test experiment. It investigated the effect of mode of text production on Grade 5 students' learning of a strategy for a new text genre. The two levels of the independent variable, mode of production, were STT software (Dragon NaturallySpeaking) versus handwriting. The dependent variables were cognitive load, text quality, number of persuasive elements in text, and number of writing errors (word errors and surface errors). There were 45 Grade 5 students from two classrooms in different schools within the Thames Valley District School Board. Every student received a series of lessons on using Dragon NaturallySpeaking, which was available on school computers. Following that, all students participated in four lessons on persuasive writing. At the end of each lesson, students composed a persuasive text. Students randomly selected for the experimental condition completed all writing using Dragon NaturallySpeaking, while students in the control group completed the writing activities using pen and paper. Cognitive load was measured using a checklist at the end of each writing assignment, and at the end of the pre and post-tests. One week after the lessons, all students completed two post-tests in both the STT and handwritten mode.

Validity

The present study was designed to meet the nine quality indicators as described by Graham and Perin (2007) in their meta-analysis of experimental research on writing instruction. The first quality indicator is random assignment of participants to conditions. Second, is mortality equivalence which is met if 90% of the students who start the study complete the study

across both conditions. The third indicator is no ceiling or floor effects at the post-test; this means that the mean scores for each dependent variable at the post-test will be at least one standard deviation away from the lowest and highest possible scores on the scale. The fourth indicator is pretest equivalence; this is achieved if students are randomly assigned to conditions, or if pretest performance is measured and found to be equivalent. Instructor training is the fifth quality indicator and is defined as having a description for the teachers of how to administer the treatments effectively. The sixth quality indicator is the type of control condition; this means that there is an alternative treatment that is clearly described as the control condition or alternative treatment. Avoidance of the Hawthorne effect is the seventh quality indicator and is described as ensuring that there is an alternative treatment for the control group that also provides them with attention and time. Finally, the last quality indicators are treatment fidelity and controlled teacher effects. Treatment fidelity is described as evidence that indicates that the treatments were administered as intended. Indication of how each of these nine quality indicators were met in the present study are described throughout the procedure (Graham and Perin, 2007).

Participant Characteristics

Participants were 45 grade 5 students recruited from two classrooms. One served a small town and surrounding rural area; the other served a rural area near a mid-sized Canadian city. Both schools served mainly lower and middle SES students of European heritage. Teachers were invited to participate in the study by a board-wide email for this grade level. At the choice of the classroom teacher, all students in the participating classrooms took part in the same writing activities, but only the data of those students who consented was used in the present study. Grade five students were selected for the focus of the present study because they have previous writing

experience and are at an appropriate age to benefit from additional instruction in persuasive writing, as it is a part of the Grade 5 curriculum in this province.

The researcher distributed a Parent Consent form (see Appendix A) and a Child Assent letter (see Appendix B) and students had approximately one week to return the signed consent forms to their classroom teacher if they wanted to participate in the study. The consent form specified that in agreeing to participate in the study students' work would be collected for research purposes only and would not affect their classroom grade (see Appendix A and B). In signing the consent form, parents and students agreed to the release of their most recent writing grade provided by the classroom teacher. To introduce the study and handout consent forms the researcher explained the following to students in each class:

"I am Ms. Haug from Western University and I am here to talk to you about a study that I want to do. (Handout consent form and letter of information). Soon, your class will be learning about persuasive writing. I want to understand how students learn about a new writing style like persuasive writing. Please read this letter of information with your parents and if you choose to be a part of this study then you and your parents can sign these forms. The work that we do during the study will not affect your grade; it will only be used for my study. If you choose not to participate then you will still learn the same lessons as your classmates and do the same work but I will not collect your work. This letter has more information for you and your parents. Please return it to your teacher by the end of next week. Thank you for listening! I will take a few minutes to answer questions. Does anyone have any questions?"

Students in all classes were eligible to participate provided that they and their parents signed and returned the consent form. There were no students excluded from the study. At any

time participants could choose to remove themselves from the study; the number of participants who choose to remove themselves from the study was zero; this fulfilled the criterion of mortality equivalence between the experimental and control group (Graham & Perin, 2007).

Confidentiality

Students' full names were recorded in a spreadsheet with a corresponding number. The number was written on the students' compositions and their original name was blacked out in order to match pretest, treatment condition persuasive writing samples and post-tests. Access to this information was shared between the primary researcher (Katrina Haug) and the supervisor (Dr. Perry Klein) of this research study. The spreadsheet that connects students' names and subject numbers was stored separately from the student compositions and SPSS statistics file to ensure confidentiality.

Procedure

The researcher provided the classroom teacher with lesson plans and materials. Each lesson was segmented into approximately 10 components; the researcher sat in on the lessons to check that each part of the lesson was included for all students, in order to establish treatment fidelity. Treatment fidelity, operationalized as the number of lesson segments, was completed as prescribed divided by the total number of lesson segments, 100%; treatment fidelity of 80% is considered valid (Graham & Perin, 2007). Providing materials and lesson plans assisted in instructor training and controlled for teacher effects. Additionally, because students in the two conditions sat together in the same argument strategy lessons within each classroom, teacher characteristics were not confounded between conditions. Each student received a workbook with the necessary materials for each lesson (Appendix I). Each lesson was based on a different

argument move. This allowed the researcher to break down the learning into manageable steps for students and to track student progress. The fact that all students in the classroom received the same instruction and there is no group that is left out, eliminated the Hawthorne effect (Graham & Perin, 2007). The instructional periods were structured as follows:

Period 1a-d: Introduction to Dragon NaturallySpeaking. All students received four sessions (approximately 30-45 minutes for each session) of instruction in the STT software, before being randomly assigned to the control or experimental condition (see Appendix C for lesson plan and activities). Students were also given a "Dragon Tip Sheet" in their workbook to assist them in using the software throughout the duration of the experiment (see Appendix I). In the initial session, students completed the training program included with the software, as developed by Nuance Communications. In the following three sessions, students practiced using the software to achieve better accuracy. These three sessions were approximately 40 minutes each. By the end of the four sessions, all students completed the training with 80% or above voice recognition accuracy. Only students randomly assigned to the experimental group continued to use the software for the four remaining instructional periods. Students in the control group switched to handwriting for the subsequent four instructional periods.

Period 1e: Pretest of Persuasive Writing. Students completed a pretest to determine their initial skill in persuasive writing. They had approximately 30-35 minutes to complete the question. The pretest was completed using handwriting for all students. The pretest and post-tests were important for assessing ceiling and floor effects along with pretest equivalence. The writing prompt for the pretest was: Imagine you are writing a letter to your parents about watching TV. In about one page, answer the question: Do you think that children should be able to choose what they watch on TV?

Period 2: Lesson on Developing Reasons. This lesson focused on teaching students to identify their opinion and to provide supporting reasons for their opinion. It required approximately 40-50 minutes. All lessons included the following: Information on one-step of the strategy; studying a model text; an activity to promote peer discussion; and writing a practice text. The instructor followed the lesson plan (see Appendix E) and students were given the worksheets required for the lesson in their workbook (see Appendix I). Following the lesson, students either handwrote or orally dictated to Dragon depending on the condition to which they had been assigned. They then responded to two Likert scale questions regarding the cognitive load of the writing task (see Appendix J). In addition, students in both the control and experimental group checked that they were including the correct persuasive elements of the strategy, by comparing their text to the checklist of argument elements found at the top of their worksheet. They were given an explanation and example of how to use this checklist as part of the lesson. The researcher collected students' compositions and responses to the cognitive load measure (only of those who consented).

Period 3: Lesson on Different Opinion and Reasons for This Opinion. This lesson focused on the alternative claim, also called the other opinion. This is an opinion other than the opinion of the writer and reasons someone may have to support that opinion. This lesson required approximately 40-50 minutes. The instructor followed the lesson plan as attached in Appendix F and students found the worksheets required for the lesson in their workbook (see Appendix I). Following the lesson, students handwrote or orally dictated (depending on their condition) a persuasive piece with the elements they had learned thus far. Students monitored whether they were including these elements using a checklist found at the top of their worksheet. In addition, they responded to two cognitive load questions concerning the writing task. The

researcher, for the purpose of this study, collected the responses (only for students who consented).

Period 4: Lesson on Writing a Rebuttal. In this lesson, students learned how to use a rebuttal to defend their opinion against the other viewpoint. The rebuttal is a contrary argument to undermine the evidence for the other side. This lesson required approximately 40-50 minutes. The instructor followed the lesson plan as attached in Appendix G and students found the worksheets required for the lesson in their workbook (see Appendix I). Following the lesson, students handwrote or orally dictated (depending on their condition) a persuasive piece with the elements they had learned thus far. Students monitored whether they were including these elements with the checklist found at the top of their worksheet. In addition, they responded to two cognitive load questions concerning the writing task. The researcher, for the purpose of this study, collected the responses (only for students who consented).

Period 5: Lesson on Writing a Conclusion. In this final lesson, students were taught to write a concluding statement. The goal of the concluding statement is to wrap up their thoughts by restating their opinion from the beginning of the paper, to summarize their argument, and to give a call to action. This lesson required approximately 40-50 minutes. The instructor followed the lesson plan as attached in Appendix H and students found the worksheets required for the lesson in their workbook (see Appendix I). Following the lesson, students handwrote or orally dictated (depending on their condition) a persuasive piece with the elements they had learned thus far. Students monitored whether they were including these elements with the checklist found at the top of their worksheet. In addition, they responded to two cognitive load questions concerning the writing task. The researcher, for the purpose of this study, collected the responses (only for students who consented).

Period 6 and 7: Post-Test(s) of Persuasive Writing. Students completed two post-tests, which were approximately one week following the last lesson. All students completed post-tests in both the STT and written modes. Students were randomly assigned to STT or written composition mode for their first post-test. Because the STT post-test took place in the computer lab, students were taken in groups of eight to complete the oral post-test. This was to ensure that students could sit far enough apart that they could not listen to each other for ideas or influence. While the students were working on the STT post-test, other students were working on the written post-test in their classroom. Students rotated over two days until everyone had completed both. The researcher collected these texts from the students who consented for the purposes of this study. See Appendix D for post-test questions and format.

Measures

Several measures were used in the collection of data:

Pretest and post-test of persuasive writing. A pretest was provided to assess students' pre-instructional skill in persuasive writing. Scores on the pretest provided the first of a series of repeated measures, which accounted for previous writing ability, and allowed gains in persuasive writing ability to be assessed. The pretest was based on the question, "Imagine you are writing a letter to your parents about watching TV. In about one page, answer the question: Do you think that children should be able to choose what they watch on TV?" The post-tests were comprised of two questions that were counter-balanced, that is, for half of the students the first question was the written post-test, while for others it was the Dragon post-test. The two possible questions, found in Appendix D, were as follows: (1) Imagine that your school was thinking about having school uniforms or if they already have school uniforms, they were thinking of getting rid of

them. Write at least one page about what you think the school should do about uniforms. (2)

Imagine you are transported 100 years into the future; do you think that the world would be a better or worse place? Try to write at least one page.

Before scoring, the texts were transcribed to conceal the conditions in which they were composed (MacArthur and Cavalier, 2004). Each handwritten text was transcribed into a word document by the primary researcher two times. The first time they were transcribed exactly as they were written, with errors preserved. The second time they were transcribed free from spelling errors. By removing spelling errors, it allowed the rater to judge the text based on persuasiveness alone. Two raters coded each feature of the text, independently, with the modality condition masked.

Cognitive load measures. The purpose of the cognitive load measure was to evaluate the working memory load of the writing conditions (Dragon NaturallySpeaking or handwriting) on the students working memory. The cognitive load measure was comprised of two Likert-scale survey questions and was attached to each writing assignment. Previous research shows that a self-report of effort and perceived difficulty comprise valid measures of working memory load (Sweller et al., 2001). See Appendix J for a copy of the Cognitive Load Measure.

Surface errors. The count of surface errors included punctuation and capitalization errors which were recorded by their frequency in the text. Raters were instructed to code capitalization errors as any missing or incorrect capitalization, and punctuation errors as missing and incorrect punctuation (see Appendix K). The analysis form was used by the secondary raters for coding purposes. Interrater reliability was calculated for all of the dependent measures. The

correlation between raters was high, ranging from $r = .87, p < .001$ to $r = .90, p < .001$ on pretests and post-tests. See Appendix K.

Word errors. The count of word errors included spelling errors, homophones, missing words, double words, pronoun errors, and misplaced words. Initially, raters were counting each apparent word error at each point in a sentence; this caused problems with agreement because it was subjective. For example the sentence: I walk to the park after school to with my friends. There are obvious missing words between "to" and "with" however, the missing words could range. For example, the sentence could be missing "play" which is only one word error or "play hide and go seek" which would have been five word errors. To avoid this inconsistency, raters were instructed to code for only one word error at every point even if they believed there to be more words missing, like the example of hide and go seek. For word errors, the source of the text was masked, and interrater reliability was very high, $r = .98, p < .001$ for pretest and written post-test and $r = .99, p < .001$ for STT post-test.

Number of persuasive elements. The persuasive writing lessons were broken down into four parts, focusing on the different parts of the argument that students needed to include in their text (see Appendices E-H). Raters evaluated these texts and coded for the number of each type of argument move that was present: (claim, reason, other opinion, reason for other opinion, rebuttal, and conclusion). For the majority of arguments moves, the count was Poisson distributed with a large number of 0 or 1 counts. To reduce the number of variables and normalize the distribution, "variety of rhetorical moves" was created. This comprised the total number of types of argument moves in the text, so students had a score from 0 - 6. If a text included at least one of each type of argument move, (claim, reason, other opinion, reason for other opinion, rebuttal, conclusion) it received a score of six. This measure is validated by research showing that elementary students

evolve from one-sided arguments toward more dialogical arguments (Nippold et al., 2005). Inter-rater reliability for rhetorical complexity was high, $r(125) = .92, p < .001$.

Holistic Quality. The purpose of this variable was to measure the students' learning about argument writing. The rating was based on the criterion, "How good is this text as an example of persuasive writing?" This purely holistic rating was used to avoid biasing raters to look specifically for the elements taught during strategy instruction. According to Graham and Perin (2007), holistic measures are the most useful for evaluating the quality of students writing. The first rater sorted the texts into seven levels, ranging from (1) very low quality to (7) very high quality, and then selected one text as the most typical example of each level. The first rater then reread and evaluated the texts at each level, to ensure intra-rater reliability. The second rater, using the same criterion question plus the index texts, rated all texts a second time (MacArthur & Cavalier, 2004). Inter-rater reliability was generally high, and ranged from $r = .75, p < .001$ to $r = .94, p < .001$.

Word count. The purpose of this measure was to represent the fluency of students' composition. The total number of words was counted electronically using the word count function of Microsoft Word.

Chapter 3: Results

Data Analysis

A repeated measures analysis of variance was used in the present study to assess students' writing samples at three points in time. The analysis included one between-subjects independent variable, instructional modality, with two levels (written argument instruction versus STT argument instruction). It also included one within-subjects independent variable, time, with three

levels (pretest, written post-test, and STT post-test). The sequence of the two post-tests was counter-balanced, so the within-subjects variable is not, strictly speaking, time, but that convention for naming is followed here. The analysis included seven dependent variables: holistic text quality; word count (fluency); variety of rhetorical moves; surface errors; word errors, and two measures of cognitive load (perceived difficulty; effort).

Inter-rater reliability was assessed by examining the agreement of ratings by two graduate students who rated all students' texts. Raters were given training to ensure that they accurately used the analysis form, which is attached in Appendix K and Appendix M. Inter-rater agreement for continuous variables, was analyzed using Pearson's r . Continuous variables for the pretest and both post-tests included: word errors and surface errors. Inter-rater agreement for the continuous variables was generally high, ranging from ($r = .78$ to $r = .99$) Inter-rater reliability for categorical variables was expressed as exact agreement. On the various types of argument moves (claim, other opinion, reasons for other opinion, rebuttal and conclusion), exact agreement between raters was also high, ranging from 82.2% to 100%; these were later combined to form the variable "variety of argument moves".

Data was screened to confirm that it met the assumptions of repeated measures analysis of variance. All dependent variables showed approximate univariate normality, except for individual types of argument moves. Most of the types of argument moves (claim, other opinion, reasons for other opinion, rebuttal and conclusion) were Poisson distributed. Consequently, the variable "variety of argument moves" was created as described above; it was normally distributed. Because most dependent variables showed small but significant departures from sphericity, multivariate repeated measures analyses were initially conducted. Then, based on the

finding that the epsilon statistic for some dependent variables was greater than .75, the Huynh-Feldt correction was applied.

The within subjects main effect, time, represents differences among the pretest, written post-test and STT post-test, collapsed across instructional conditions. Planned contrasts based on time were used to test the difference between the pretest and the written post-test. This planned contrast corresponds to the first set of hypotheses: that both modes of instruction (collapsed together) would result in significant learning, that is, pretest to written post-test gains on measures of writing. Follow-up t-tests were conducted to locate whether significant gains occurred for both instructional conditions.

The second hypothesis was that both instructional modalities would contribute to learning, as operationalized by pretest to post-test gains on the STT post-test. Planned contrasts were used to test the difference between the STT post-test and the pretest. Follow-up t-tests were used to locate whether significant gains occurred for both instructional conditions.

The within-subjects time by treatment interaction represented the relative gains (slopes) of the two instructional groups across the pretest, written post-test, and STT post-test. The third set of hypotheses, that STT instruction, relative to written instruction, would result in greater learning, was represented by this interaction.

The within-subjects time by treatment interaction was also used to test the fourth set of hypotheses. This was framed in terms of two competing hypotheses: modality specific learning would be supported by an interaction between instructional condition and post-test modality (written versus dragon post-test) such that students scored significantly higher on the post-test in the same modality as their training. Conversely, the transfer hypothesis would be supported by a

lack of treatment by post-test modality interaction. In itself, a null finding cannot be used to support a hypothesis; however the transfer hypothesis would be further supported if, as per hypothesis 1 above, significant pretest to post-test gains, for a given instructional modality, were to occur in both post-test modalities.

Fluency (Word Count)

As mentioned above, word count was recorded by the researcher using the Microsoft word count function. The repeated-measures analysis showed that the between-subjects independent variable, instructional modality, did not have a significant effect (Table 1 and 2). Recall that this term collapses across the three testing times, so it does not correspond to any of the hypotheses.

Table 1.

*Fluency (Word Count) at Pretest, Written Post-test and Speech-to-Text Post-test
By Treatment Condition*

Treatment	n	Pretest <i>M(SD)</i>	Written Post-test <i>M(SD)</i>	Speech-to-Text Post-Test <i>M(SD)</i>
Speech-to-text	23	95.70 (40.19)	135.52 (74.07)	138.87 (49.75)
Handwriting	22	107.05 (55.07)	137.77 (77.25)	125.59 (49.06)

Table 2.

Repeated Measures Summary Table for Fluency†

Source	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P</i>	η^2
Between-Subjects						
Intercept	685079.52	1	685079.52	344.626	<.001	.89
Treatment	.13	1	.13	.00	.94	.00
Error	126.20	43	2.74			
Within-Subjects						
Time	33227.69	2	16613.85	7.37	.001	.15
Time * treatment	3487.72	2	1743.86	.77	.47	.02
Error	193848.97	86	2254.06			

† Huynh-Feldt correction

With respect to the first hypothesis, that both modalities of instruction would lead to significant gains from pretest to written post-test, the within-subjects effect (time) was statistically significant and large in size (Table 3). In a planned contrast, the word count on the written post-test showed a large, statistically significant difference from the pretest (Table 4). Follow-up t-tests showed that the gain from pretest to STT post-test was significant for the STT instruction condition, $t(22) = -2.47, p = .01$; this gain was also significant for the written instruction condition, $t(21) = -2.16, p = .02$.

With respect to the second hypothesis, the planned contrast showed that there was a large, statistically significant gain from the pretest to STT post-test (Table 4). Follow-up t-tests showed

that this gain was significant for the STT instruction condition $t(22) = -3.47, p = .001$; however, gains were not significant for the written instruction condition, $t(21) = -1.48, p = .08$.

With respect to the third hypothesis, that STT instruction would have a greater effect than written instruction, the test for a within-subjects time by treatment interaction was not statistically significant (Table 3). Similarly, planned contrasts showed that the two instructional groups did not differ significantly in the gains that they made from pretest to written post-test; nor did they differ in the gains that they made from pretest to STT post-test (Table 4).

With respect to the fourth hypothesis, there was an absence of a significant instructional condition by time interaction, $F(1, 43) = .57, p = .46$, partial $\eta^2 = .01$. This is consistent with the t-tests reported above, in which the STT instructional condition produced significant effects on word count in both post-test modalities. The lack of a treatment condition by post-test modality interaction is somewhat inconsistent with the lack of significant gains that students in the writing condition made as measured by the STT post-test. That is, the written instruction modality results were somewhat “between” transfer and modality specific learning; transfer was clear from STT training to the handwritten post-test; it was less clear from instruction through handwriting to the STT post-test.

Table 3.

Tests of Within-Subjects Contrasts for Fluency

Source	Time	SS	Df	MS	F	P	η^2
Time	Written PT vs Pretest	55972.33	1	55972.33	10.68	.002	.20
	Dragon PT vs Pretest	42833.24	1	42833.24	12.22	.001	.22
Time *	Written PT vs Pretest	930.91	1	930.91	.18	.68	.00

treatment	Dragon PT vs Pretest	6820.44	1	6820.44	1.95	.17	.04
Error	Written PT vs Pretest	225321.67	43	5240.04			
(time)	Dragon PT vs Pretest	150782.76	43	3506.58			

Written PT = written post-test; Dragon PT = Dragon post-test

Surface Errors

The variable surface errors consisted of capitalization errors and punctuation errors. Recall that the error measures were not considered measures of strategy learning, while the other text measures (text quality, word count, variety of rhetorical moves) were. The repeated-measures analysis showed that the between-subjects independent variable, instructional modality, did not have a significant effect (Table 4 and 5).

Table 4.

*Surface Errors at Pretest, Written Post-test and Speech-to-Text Post-test
By Treatment Condition*

Treatment	N	Pretest <i>M(SD)</i>	Written Post-test <i>M(SD)</i>	Speech-to-Text Post-Test <i>M(SD)</i>
Speech-to-text	23	7.20 (5.13)	12.02 (10.89)	5.15 (3.85)
Handwriting	22	9.91 (13.72)	11.14 (15.52)	4.45 (4.08)

With respect to the first hypothesis, that both modalities of instruction would lead to a significant difference from pretest to written post-test, the within-subjects effect (time) was statistically significant and large in size (Table 5). In a planned contrast, the surface errors on the

written post-test showed a large, statistically significant difference from the pretest (Table 6).

Follow-up t-tests showed that the increase in surface errors from pretest to written post-test was significant for the STT instruction condition, $t(22) = -2.17, p = .04$; however, was not significant for the written instruction condition, $t(21) = 1.38, p = .18$.

With respect to the second hypothesis, that both modalities of instruction would lead to a significant difference from pretest to STT post-test the within-subjects effect (time) was statistically significant and large in size (Table 5). Planned contrasts showed that there was a statistically significant difference with large effect from the pretest to STT post-test (Table 6). Follow-up t-tests showed that this decrease in surface errors was significant for the written instruction condition $t(21) = 1.82, p = .001$; however, there was no significance for the STT instruction condition, $t(22) = 1.63, p = .12$.

In regards to the third hypothesis, that STT instruction would have a greater effect than written instruction, the test for a within-subjects time by treatment interaction was not statistically significant (Table 5). Similarly, planned contrasts showed that the two instructional groups did not differ significantly in the number of surface errors from pretest to written post-test; nor did they differ in the number of surface errors from pretest to STT post-test (Table 6).

Table 5.

Repeated Measures Summary Table for Surface Errors†

Source	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P</i>	η^2
Between-Subjects						
Intercept	9321.55	1	9321.55	50.25	<.001	.54

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Treatment	4.80	1	4.80	.03	.87	.00
Error	7976.54	43	185.50			
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Within-Subjects						
Time	1036.38	1.73	600.49	9.10	.001	.18
Time * treatment	92.29	1.73	53.47	.81	.43	.02
Error	4897.15	74.21	65.99			

† Huynh-Feldt correction

With respect to the fourth hypothesis, investigating the interaction between modality of instruction and modality of learning, the absence of a significant instructional group by time interaction was again reflected in the fact that an additional planned contrast showed no interaction between instructional condition and post-test modality, $F(1.7) = .81, p = .43$, partial $\eta^2 = .02$. This is somewhat consistent with the t-tests reported above, in which the STT instructional condition produced significant effects on the written post-test, while the written instructional condition produced significant effects on the STT post-test. The lack of a treatment condition by post-test modality interaction is somewhat inconsistent with significant relationships that were found between modality and post-test. That is, the results somewhat supported transfer of learning as significance was found for the post-test modality that was opposite to students' instructional modality.

Table 6.

Tests of Within-Subjects Contrasts for Surface Errors

Source	Time	SS	df	MS	F	P	η^2
Time	Written PT vs Pretest	412.03	1	412.03	6.18	.02	.13

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	Dragon PT vs Pretest	632.17	1	632.17	5.52	.02	.11
Time *	Written PT vs Pretest	145.63	1	145.63	2.18	.15	.05
Treatment	Dragon PT vs Pretest	130.83	1	130.83	1.14	.29	.03
Error	Written PT vs Pretest	2866.67	43	66.67			
(time)	Dragon PT vs Pretest	4924.41	43	114.52			

Written PT = written post-test; Dragon PT = Dragon post-test

Word Errors

The variable word errors represented the total number of misspelled words, misplaced words, wrong word choice, missing words and double words. The repeated-measures analysis showed that the between-subjects variable, instructional modality did not have a significant effect (Table 7 and 8).

Table 7.

Word Errors at Pretest, Written Post-test and Speech-to-Text Post-test

By Treatment Condition

Treatment	N	Pretest <i>M(SD)</i>	Written Post-test <i>M(SD)</i>	Speech-to-Text Post-Test <i>M(SD)</i>
Speech-to-text	23	12.07 (6.15)	17.93 (13.28)	10.91 (11.17)
Handwriting	22	16.02 (13.68)	21.52 (21.36)	8.75 (6.60)

Table 8.

Repeated Measures Summary Table for Word Errors†

Source	SS	Df	MS	F	P	η^2
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THE EFFECT OF SPEECH-TO-TEXT SOFTWARE ON LEARNING A NEW WRITING STRATEGY

Between-Subjects						
Intercept	9501.96	1	9501.96	94.31	<.001	.69
Treatment	36.20	1	36.20	.36	.55	.00
Error	4332.41	43	100.75			
Within-Subjects						
Time	2219.15	1.75	1270.58	10.74	.001	.20
Time * treatment	264.88	1.75	151.66	1.28	.28	.03
Error	8884.26	43.00	206.611			

† Huynh-Feldt correction

With respect to the first hypothesis, that both modalities of instruction would lead to a significant difference from pretest to written post-test, the within subjects effect (time) was statistically significant and large in size (Table 8). In a planned contrast, the number of word errors showed a large, statistically significant difference between pretest and post-test. Follow-up t-tests showed that the difference in word errors was significant for the STT instruction, $t(22) = -2.28, p = .03$ condition, but was not significant for the written instruction condition (Table 9).

In terms of the second hypothesis, that both modalities of instruction would lead to a significant difference from pretest to STT post-test, a planned contrast showed that the difference in word errors from pretest to STT post-test was statistically significant and had a large effect (Table 9). Follow-up t-tests showed that there was a significance difference from pretest to STT post-test in the written instruction condition $t(21) = 2.88, p = .009$ but not in the STT instruction condition.

With respect to the third hypothesis, that STT instruction would have a greater effect than written instruction, the test for a within-subjects time by treatment interaction was not statistically significant (Table 8).

Table 9.

Tests of Within-Subjects Contrasts for Word Errors

Source	Time	SS	df	MS	F	P	η^2
Time	Written PT vs Pretest	1453.54	1	1453.54	8.60	.005	.17
	Dragon PT vs Pretest	789.12	1	789.12	5.34	.03	.11
Time *	Written PT vs Pretest	1.54	1	1.54	.009	.93	.00
Treatment	Dragon PT vs Pretest	421.23	1	421.23	2.82	.10	.06
Error (time)	Written PT vs Pretest	7267.61	43	169.01			
	Dragon PT vs Pretest	6433.08	43	149.61			

Written PT = written post-test; Dragon PT = Dragon post-test

In regards to the fourth hypothesis, that there would be modality specific learning or transfer of learning, the absence of a significant instructional group by time interaction was also reflected in planned contrasts which showed no interaction between instructional modality and post-tests, $F(1.75) = 1.28, p = .28, \text{partial } \eta^2 = .03$. This is inconsistent with the t-tests reported above, in which the STT instructional condition produced a significant difference between pretest and written post-test while the written condition produced a significant difference between pretest and STT post-test. The lack of a treatment condition by post-test modality interaction is somewhat inconsistent with the significant gains that students in the writing condition made as measured by the STT post-test and students in the STT condition made as measured by the written post-test. That is, the written instruction modality and STT instruction modality results

suggest transfer of learning although results were somewhat “between” transfer and modality specific learning.

Rhetorical Moves

The variable rhetorical moves represents the number of types of argument moves that the student included in the text. As a reminder, rhetorical moves included: claim, reasons, other opinion, reasons for other opinion, rebuttal and conclusion and students could score a maximum of six if they included all the elements. The repeated-measures analysis showed that the between-subjects independent variable, instructional modality, did not have a significant effect (Table 10 and 11).

Table 10.

*Rhetorical Moves at Pretest, Written Post-test and Speech-to-Text Post-test
By Treatment Condition*

Treatment	N	Pretest <i>M(SD)</i>	Written Post-test <i>M(SD)</i>	Speech-to-Text Post-Test <i>M(SD)</i>
Speech-to-text	23	2.39 (0.58)	5.26 (1.21)	5.35 (1.15)
Handwriting	22	2.68 (1.09)	5.00 (1.27)	4.91 (1.44)

Table 11.

Repeated Measures Summary Table for Rhetorical Moves†

Source	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P</i>	<i>η²</i>
Between-Subjects						

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Intercept	818.21	1	818.21	1117.64	.000	.96
Treatment	.209	1	.209	.29	.60	.01
Error	31.48	43	.73			
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Within-Subjects						
Time	201.59	2	100.80	112.17	.000	.72
Time * treatment	3.25	2	1.63	1.81	.17	.04
Error	77.28	86	.90			

† Sphericity Assumed

With respect to the first hypothesis, that both modalities of instruction would lead to significant gains from pretest to written post-test, the within-subjects effect (time) was statistically significant and large in size (Table 11). In a planned contrast, the number of rhetorical elements on the written post-test showed a large, statistically significant difference from the pretest (Table 12). Follow-up t-tests showed that the gain from pretest to written post-test was significant for STT instruction condition, $t(22) = -10.97, p = .00$, and for the written instruction condition, $t(21) = -6.86, p = .00$.

In regards to the second hypothesis, that both modalities of instruction would lead to significant gains from pretest to STT post-test planned contrasts showed that the number of rhetorical elements on the STT post-test showed a large, significant difference from the pretest (Table 12). Follow-up t-tests showed that the gain from pretest to STT post-test was significant for the written instruction condition, $t(21) = -5.73, p = .00$, and for the STT instruction condition, $t(22) = -13.88, p = .00$.

With respect to the third hypothesis, that STT would have a greater effect than written instruction, the test for within-subjects effect time by treatment was not statistically significant (Table 12).

Table 12.

Tests of Within-Subjects Contrasts for Rhetorical Moves

Source	Time	SS	df	MS	F	p	η^2
Time	Written PT vs Pretest	302.62	1	302.62	148.92	.000	.78
	Dragon PT vs Pretest	302.16	1	302.16	139.98	.000	.77
Time *	Written PT vs Pretest	3.42	1	3.42	1.68	.20	.04
Treatment	Dragon PT vs Pretest	5.98	1	5.98	2.77	.10	.06
Error (time)	Written PT vs Pretest	87.38	43	2.03			
	Dragon PT vs Pretest	92.82	43	2.16			

Written PT = written post-test; Dragon PT = Dragon post-test

As for the fourth hypothesis, that there would be modality specific learning or transfer of learning, the absence of a significant instructional group by time interaction was again reflected in the fact that an additional planned contrast showed no interaction between instructional condition and post-test modality, $F(2) = 1.81$, $p = .17$, partial $\eta^2 = .04$. This is consistent with the t-tests reported above, in which the STT instructional condition and the written instruction condition both produced significant effects for rhetorical moves on both the written post-test and the STT post-test, which supports transfer of learning from one modality to the other.

Holistic Quality Rating

The variable holistic quality represents the overall persuasiveness of the texts. As previously mentioned, texts were scored based on a 7-point scale by two raters. The repeated-measures analysis showed that the between-subjects independent variable, instructional modality, did not have a significant effect (Table 13 and 14).

Table 13.

Holistic Quality at Pretest, Written Post-test and Speech-to-Text Post-test

By Treatment Condition

Treatment	N	Pretest M (SD)	Written Post-test M(SD)	Speech-to-Text Post-Test M (SD)
Speech-to-text	23	2.78 (.97)	5.13 (1.11)	4.80 (1.82)
Handwriting	22	2.23 (1.00)	4.18 (1.56)	4.41 (1.60)

With respect to the first hypothesis, that both modalities of instruction would lead to significant gains from pretest to written post-test, the within-subjects effect (time) was statistically significant and large in size (Table 14). In a planned contrast, the holistic quality on the written post-test showed a large, statistically significant difference from the pretest to the written post-test (Table 15). Follow-up t-tests showed that the gain from pretest to written post-test was significant for the STT instruction condition, $t(22) = -11.75, p = .00$; and was also significant for the written instruction condition, $t(21) = -5.02, p = .00$.

As for the second hypothesis, that both modalities of instruction would lead to significant gains from pretest to STT post-test the planned contrast showed that there was a statistically

significant gain in holistic quality from the pretest to STT post-test (Table 15). Follow-up t-tests showed that this gain was significant for the written instruction condition $t(21) = -5.83, p = .00$; as well as significant for the STT instruction condition, $t(22) = -5.67, p = .00$.

Table 14.

Repeated Measures Summary Table for Holistic Quality†

Source	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P</i>	η^2
Between-Subjects						
Intercept	2076.19	1	2076.19	590.34	.000	.93
Treatment	13.52	1	4.80	.03	.87	.00
Error	151.23	43	3.52			
Within-Subjects						
Time	135.65	1.87	72.74	61.00	.000	.59
Time * treatment	1.82	1.87	.98	.82	.44	.02
Error	95.62	80.19	1.19			

† Huynh-Feldt Correction

With respect to the third hypothesis, that STT instruction would have a greater effect than written instruction, the test for a within-subjects time by treatment interaction was not statistically significant (Table 15). Similarly, planned contrasts showed that the two instructional groups did not differ significantly in the gains that they made from pretest to written post-test; nor did they differ in the gains that they made from pretest to STT post-test (Table 16).

Table 15.

Tests of Within-Subjects Contrasts for Holistic Quality

Source	Time	SS	df	MS	F	p	η^2
Time	Written PT vs Pretest	208.14	1	208.14	99.26	.000	.70
	Dragon PT vs Pretest	198.69	1	198.69	66.22	.000	.61
Time *	Written PT vs Pretest	1.74	1	1.74	.83	.37	.02
Treatment	Dragon PT vs Pretest	.29	1	.29	.10	.76	.00
Error (time)	Written PT vs Pretest	90.17	43	2.10			
	Dragon PT vs Pretest	129.01	43	3.00			

Written PT = written post-test; Dragon PT = Dragon post-test

In regards to the fourth hypothesis, that there would be modality specific learning or transfer of learning, the absence of a significant instructional group by time interaction was again reflected in the fact that an additional planned contrast showed no interaction between instructional condition and post-test modality, $F(1.87) = .82, p = .44$, partial $\eta^2 = .02$. This is inconsistent with the t-tests reported above, as both the STT instruction condition and the written instruction condition resulted in a significant increase in holistic quality from pretest to both written post-test and STT post-test. That is, both the written instruction modality and STT modality results produced favourable results on transfer of learning from one modality to the other.

Cognitive Load

The variable cognitive load was measured using two 9-point Likert scale questions where students had to rate (1) How easy or difficult was this writing activity? and (2) How much effort did you put into this writing activity?

Perceived difficulty. The repeated-measures analysis showed that the between-subjects independent variable, instructional modality, did not have a significant effect for the first question regarding difficulty (Table 16 and 17). With respect to the first hypothesis, that both modalities of instruction would lead to significant increase from pretest to written post-test, the within-subjects effect (time) was not significant. Also, for the second hypothesis, that both modalities of instruction would lead to a significant increase from pretest to STT post-test the within-subjects effect (time) was not significant. For the third hypothesis (STT instruction would have a greater effect than written instruction) and fourth hypothesis (was there modality specific learning or a transfer of learning) the results for perceived difficulty were also not significant.

Effort. With respect to the first hypothesis, that both modalities of instruction would lead to a significant increase from pretest to written post-test, the within-subjects effect (time) was statistically significant and large in size (Table 17). In a planned contrast, there was a large, statistically significant difference in reported effort between pretest and written post-test (Table 18). Follow-up t-tests showed that the increase from pretest to written post-test was significant for the STT instruction condition, $t(22) = -2.99, p = .01$; and was not significant for the written instruction condition, $t(21) = -2.02, p = .06$.

As for the second hypothesis, that both modalities would lead to significant gains from pretest to STT post-test, the planned contrast showed that this was true, there was a statistically significant gain for reported effort from the pretest to STT post-test (Table 18). Follow-up t-tests showed that this gain was significant for the STT instruction condition $t(22) = -3.60, p = .00$; but was not significant for the written instruction condition, $t(21) = -.20, p = .84$.

With respect to the third hypothesis, that STT instruction would have a greater effect than written instruction, the test for a within-subjects time by treatment interaction was statistically significant. In a planned contrast, time by participant condition was significant and had a large effect for an increase in effort from the pretest to the STT post-test (Table 17).

In regards to the fourth hypothesis, that there would be modality specific learning or transfer of learning, there was a significant instructional group by time interaction with a small effect. In a planned contrast, however, it was shown that the only significant effects were from pretest to STT post-test, $F(1) = 6.52, p = .01, \text{partial } \eta^2 = .13$. This is consistent with the t-tests reported above, as the STT instruction condition resulted in significant increase in perceived effort from pretest to both written post-test and STT post-test. The presence of a treatment condition by post-test modality interaction is consistent with the significant increase in effort that students in the STT condition reported as measured by the STT and written post-tests. As a result, the written instruction modality and STT modality results were in-between transfer of learning from one modality to the other due to the lack of significance for the other conditions as well as the small main effect.

Table 16.

Cognitive Load at Pretest, Written Post-test and Speech-to-Text Post-test

By Treatment Condition

Treatment	N	Pretest	Written Post-test	Speech-to-Text Post-Test
		<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>

Question 1:

Difficulty

THE EFFECT OF SPEECH-TO-TEXT SOFTWARE ON LEARNING A NEW WRITING STRATEGY

Speech-to-text	23	3.57 (1.44)	4.04 (1.72)	4.04 (2.34)
Handwriting	22	3.82 (1.71)	4.41 (1.53)	3.91 (2.00)
Question 2:				
Effort				
Speech-to-text	23	5.70 (1.33)	6.91 (2.13)	7.04 (1.69)
Handwriting	22	6.00 (1.11)	6.68 (1.43)	6.06 (1.53)

Table 17.

Repeated Measures Summary Table for Cognitive Load Q1 (Difficulty)†

Source	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P</i>	η^2
Between-Subjects						
Intercept	2121.06	1	2121.06	460.78	.000	.92
Treatment	.88	1	.88	.19	.66	.00
Error	197.94	43	4.60			
Within-Subjects						
Time	6.44	1.75	3.69	1.21	.30	.03
Time * treatment	1.55	1.77	.87	.29	.72	.01
Error	228.04	75.06	3.04			

† Huynh-Feldt Correction

Repeated Measures Summary Table for Cognitive Load Q2 (Effort)†

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P</i>	η^2
Between-Subjects						
Intercept	5527.50	1	5527.50	1174.53	.000	.97

THE EFFECT OF SPEECH-TO-TEXT SOFTWARE ON LEARNING A NEW WRITING STRATEGY

Treatment	3.05	1	3.05	.65	.43	.02
Error	202.36	43	4.71			
<hr/>						
Within-Subjects						
Time	21.91	2	10.96	8.04	.001	.16
Time * treatment	9.29	2	4.644	3.41	.04	.07
Error	117.21	86	1.36			
<hr/>						
† Sphericity Assumed						

Table 18.

Tests of Within-Subjects Contrasts for Cognitive Load Q1 (Difficulty)

Source	Time	SS	df	MS	F	p	η^2
Time	Written PT vs Pretest	12.85	1	12.85	3.61	.06	.77
	Dragon PT vs Pretest	3.64	1	3.64	.48	.49	.01
Time *	Written PT vs Pretest	.143	1	.143	.04	.84	.00
Treatment	Dragon PT vs Pretest	1.69	1	1.69	.22	.64	.00
Error (time)	Written PT vs Pretest	153.06	43	3.56			
	Dragon PT vs Pretest	329.56	43	7.66			

Written PT = written post-test; Dragon PT = Dragon post-test

Tests of Within-Subjects Contrasts for Cognitive Load Q2 (Effort)

Source	Time	SS	df	MS	F	p	η^2
Time	Written PT vs Pretest	40.56	1	40.56	12.76	.000	.23
	Dragon PT vs Pretest	22.55	1	22.55	7.99	.01	.16
Time *	Written PT vs Pretest	3.25	1	3.25	1.02	.32	.02

Treatment	Dragon PT vs Pretest	18.41	1	18.41	6.52	.01	.13
Error	Written PT vs Pretest	136.69	43	3.18			
(time)	Dragon PT vs Pretest	121.37	43	2.82			

Written PT = written post-test; Dragon PT = Dragon post-test

Chapter 4: Discussion

General

Allowing students to compose a text while removing the burdens associated with transcription, as is done while using speech-to-text technology (STT), has been shown to lead to better quality writing in struggling writers (Higgins & Raskind, 1995; MacArthur & Cavalier, 2004). These findings could be a result of written composition being a very cognitively intensive task for students in comparison to oral composition (Bourdin & Fayol, 1994). The present study sought to extend the research on this topic by investigating whether STT technology, in this case Dragon NaturallySpeaking, could help students to learn a new writing strategy (persuasive writing), by looking at the effects of STT compared to writing in a pretest-post-test randomized experimental design.

Overall, results from the repeated measures analyses of variance and planned contrasts revealed that for word count, word errors, surface errors, rhetorical moves, and holistic quality students improved significantly from pretest to post-test, with large effect sizes, in both instruction conditions. The results indicated that there was transfer of learning rather than modality specific learning for most dependent variables.

Discussion of Research Hypotheses

Learning gains from pretest to written post-test. Recall that the first hypothesis was that both of the instructional modalities (STT and handwriting) would produce learning gains from pretest to written post-test. This hypothesis was supported by results showing that holistic quality and variety of rhetorical moves improved for students in both instructional conditions. The finding that word count increased from pretest for both modalities also supported this hypothesis.

These results extend previous research on strategy instruction by showing that it is an effective teaching method for students composing in different modalities. Previously, strategy instruction has been shown to be effective for teaching students persuasive writing when composing using handwriting (Graham et al., 2012). Results of the current study indicated that strategy instruction is an effective teaching method for improving student learning on persuasive writing in both STT and handwritten modalities. Students in both groups (handwriting and STT) began with very basic arguments at pretest, using limited rhetorical moves, including only a claim and reasons. In comparison, their writing was significantly better at written post-test in terms of quality and the number of rhetorical moves included. By post-test, most students were including four or more types of rhetorical moves, which would account for the higher holistic ratings, variety of rhetorical moves, and higher word count.

Learning gains from pretest to STT post-test. Recall that the second hypothesis was that both modalities would produce learning gains from pretest to STT post-test. This hypothesis was supported by the results showing that holistic quality improved for students in both conditions and students included greater variety of rhetorical moves. It was not fully supported by the results based on the variable word count, which had a significant increase on the STT post-test but only for the STT condition. Students in the STT condition had more practice using

the technology, as they used it during the persuasive writing lessons in addition to the training the all the students received. This could explain why word count significantly increased only for students in the STT condition on the STT post-test.

The present study was one of few studies to investigate the role of STT in learning. As noted in the introduction, most research on STT has focused on the effects of this technology on a specific piece of writing (e.g., MacArthur & Cavalier, 2004; Quinlan, 2004). Previous research on the effect of STT on *learning* has focused only on basic writing skills, showing that long-term use of this technology can contribute to decoding and spelling, as well as reading comprehension (Higgins & Raskind, 1997; Higgins & Raskind, 2000). The present study extended this research, as the first to show that STT can be used to support learning a writing strategy in that students showed significant improvement from pretest to STT post-test in both the experimental (STT) and control (handwriting) conditions.

Does STT, compared to handwriting, have a greater effect on learning? This is the first study of its kind to look at the relationship of STT on learning a new writing strategy in comparison to handwriting. Recall that this third hypothesis focused on the question "Would STT have a greater effect on learning a new writing strategy when compared to handwriting?" This hypothesis was not supported by the results based on the variables: word count, variety of rhetorical moves, and holistic quality. These results indicate that STT was not more effective than writing and conversely writing was not more effect than STT on learning.

Previous research examining working memory could be extended to these findings by considering the demands that each instructional modality made on writers (Graham, 2014; McCutchen, 1996). It has been established in previous research that handwriting and spelling

place a burden on the working memory of young writers and struggling writers (Berninger et al., 1994). However, it has become increasingly apparent that STT technology also places a burden on working memory in different ways (MacArthur & Cavalier, 2004). Students still need to think about the rhetorical elements necessary for a persuasive text as well as where to insert punctuation and capitalization. Additionally, STT produces a small but consistent percentage of errors in word recognition, which the writer must correct. This could explain why neither modality was more effective than the other for supporting student learning. Rather, in conjunction with strategy instruction, both modalities allowed significant learning gains for students from pretest to post-tests.

Transfer of learning. Recall that the final hypothesis was that there would be a transfer of learning between the two modalities (STT and handwriting). Transfer of learning indicates that students were able to take the knowledge that they learned about the writing strategy in one modality, and transfer it to compose effectively in the other modality. This hypothesis was supported by the variables variety of rhetorical elements and holistic quality. However, the hypothesis was not completely supported by the variable word count which, showed effects that could be said to be in-between transfer and modality specific learning. This is because there was an increase in word count for both modalities from pretest to post-test but these results were not found to be significant which indicates that the results were in-between and leaned towards transfer of learning.

Previously, STT has been shown to have positive effects on holistic quality for a specific piece of writing and students without exceptionalities who composed in both handwriting and STT were equally successful in both modalities (MacArthur & Cavalier, 2004). However, the present study extended this research and showed that students in both modalities were able to

transfer their learning in terms of holistic quality and variety of rhetorical moves. This is important because it is evidence that STT could be a promising alternative to handwriting, and students who learn a writing strategy using STT would be able to transfer what they learned to another modality such as handwriting.

Psychologically, contemporary theories of writing development present transcription and discourse production as largely independent elements, which combine to contribute to the overall written composition (Kim & Schatschneider, 2016; Niedo, Abbott & Berninger, 2014). These results are consistent with such theories, in the sense that the participants' newly learned skills in discourse production for arguments were not "tied" to a particular mode of transcription. Rather, they were able to combine their argumentation skills with either handwriting or STT to produce high quality texts at post-test.

Surface Errors and Word Errors

Surface errors and word errors were measured for all texts in pretest and both post-tests. Recall that surface errors included punctuation and capitalization errors, while word errors included spelling, misplaced words, double words, missing words, or wrong word choice. Results for word errors and surface errors did not contribute to hypotheses regarding learning, because the hypotheses focused on strategy instruction and discourse-level characteristics of text, such as quality. However, the results are interesting in relation to the use of STT. It was noted that the handwritten post-test texts were substantially longer than the pretest texts, which were also handwritten. Consequently, it appears that the increase in errors from pretest to post-test was not the result of an increase in error rate, but a result of the increase in the total length of the texts written. The number of errors was lower on the STT post-test than the handwritten post-test, and

these two types of text did not differ significantly in length. These results add to our understanding of STT technology, by suggesting that it is effective for decreasing surface level errors like spelling and punctuation (Higgins & Raskind, 1995; Higgins & Raskind, 1997; Quinlan, 2004, MacArthur & Cavalier, 2004).

Cognitive Load (Effort and Difficulty)

Recall that cognitive load was discussed as being a possible mediator and that it was measured in terms of effort and difficulty. In general, perceived difficulty did not differ between the conditions, (handwriting and STT). Since, there was no difference between the conditions; cognitive load as operationalized by difficulty could not have mediated any effects on learning. Instead, both conditions were perceived as not difficult. This similarity between conditions in cognitive load was paralleled the results showing that scores on most dependent variables did not differ between the conditions. This indicates that cognitive load, operationalized as perceived difficulty, did not mediate any possible effects of modality on learning, and in fact, there were no effects of modality on learning to be mediated.

However, for the cognitive load question regarding effort, students reported putting the least amount of effort into the pretest and more effort into the two post-tests. The increase in reported effort from pretest to both post-tests was significant for students in the STT condition. In addition, students in the handwriting condition reported putting the most effort into the handwritten post-test and students in the STT condition reported putting the most effort into the STT post-test. Although these students (written condition) had less practice using the STT technology, they reported putting less effort into the STT post-test when compared to the handwritten post-test. A possible explanation for the increase of reported effort from pretest to

post-test is that at the pretest, students were unaware of the rhetorical elements necessary to write a persuasive text and as a result found the pretest question to be quite simple and to require little effort. After learning about persuasive writing, the post-tests may have required more effort because students knew that they were meant to include a variety of rhetorical elements (i.e., claim, reasons, and reasons for other opinion, rebuttal and conclusion).

Educational Implications

Overall, students were able to transfer what they learned about persuasive writing to compose in both modalities (handwriting and STT). Results of the study indicate that for Grade 5 STT can be an effective way to learn a new writing strategy. Although the lack of statistically significant differences between the instructional conditions at post-test does not mean that the two instructional conditions were exactly equally effective, the similarity of the means suggests that they are approximately equally effective. Students did not report that STT was difficult to use, and it helped to decrease surface errors and word errors in students' compositions.

Possible considerations for the teacher wishing to try this in the classroom are that it takes time to train students and it would be very difficult to train an entire classroom at the same time. Training a large group of students at once could have negative effects on use of the software due to too much background noise. In the present study, the researcher had access to the computer lab and was able to train ten students at a time. Teachers wishing to try STT in their classroom could potentially have half the classroom practicing silent reading or another quiet activity while other students work on STT, and then rotate.

In conclusion, there are some considerations to using STT; it is time consuming and can be challenging to use in large groups. However, the findings of the present study indicate that in

using the technology students are able to learn a new writing strategy and transfer their knowledge to a different mode of composition, such as handwriting. This would give the weaker writers in the classroom a chance to explore a different method of composition without compromising their learning.

Limitations

There were several limitations to the present study. The original plan was to have approximately 60 students to participate from four different classrooms. However, due to time constraints and a teacher job action, the present study included 45 students from two different classrooms. Having more participants could increase statistical power; however, differences in the effect of the two treatments were small and probably would not have become statistically significant with a larger sample. It is possible that some of the transfer effects, which were small to medium in size, could have been statistically significant with a larger sample.

As a pedagogical limitation, STT reduces the demands associated with handwriting and spelling, but it does add its own cognitive demands. Although research has shown that STT software is beneficial to students in that it can simplify text production, it does add a new dimension of oral language to composition. Oral language is automatized for most people, but it is not without cognitive load demands of its own. Additionally, transcription skills are an important predictor of writing development (Kim & Schatschneider, 2016; Niedo, Abbott & Berninger, 2014); and for elementary children, instruction in handwriting increases the quality of written composition (see Santangelo & Graham, 2015 for a meta-analysis). This means that opportunities to practice handwriting to the point of automaticity should not be replaced by a technology such as STT, except for students with exceptionalities that require such support.

Future Research

For future research, the present study should be replicated with more participants to include a larger sample size. The inclusion of more participants could give the study more statistical power. In addition, it would be beneficial to include students in a much younger grade. The present study worked with grade five students and found that for most of the dependent variables students in both instructional conditions improved. While this is important in showing that using STT technology is not detrimental to students learning and performance, it would be interesting to use a sample of younger students whose transcription abilities are weaker. Additionally, the study should be replicated to use STT to teach a writing strategy to students with learning disabilities. It is possible that for students who struggle with spelling, the use of STT could make a greater difference for learning a writing strategy.

Conclusion

The present study was motivated by previous research showing that transcription as a part of the writing process places a large burden on the working memory of students, especially in the younger grades. It was theorized that use of STT could reduce the working memory demands caused by transcription. The present study investigated the effects of learning a new writing strategy on Grade 5 students in two conditions: using STT technology and handwriting. Each instructional modality produced gains in both modalities of post-test, on most of the dependent variables. That is, students in both groups showed significant improvement from pretest to post-tests. This is important because not only did students improve but also they were able to transfer their learning from one modality to the other. The most important contribution of this study is showing that STT can be used to teach a writing strategy. Previous research has been limited to

showing that STT can support a single piece of writing (Quinlan, 2004); and that extended use of STT improves spelling and decoding (Higgins & Raskind, 1995; Higgins & Raskind, 1997).

Overall, the results indicate that STT technology, specifically Dragon NaturallySpeaking, is a promising alternative for students learning to write in a new genre, in that it allowed students to learn a new writing strategy as effectively as handwriting, and students transferred this strategy from STT to the handwritten modality.

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Appendix A

Letter of Information



Project Title: The Effect of Speech-to-Text Technology on Learning a New Writing Strategy

Principal Investigator: Katrina Haug, Faculty of Education, Western University

Letter of Information

1. Invitation to Participate

Your child is being invited to participate in this research study about the software program Dragon NaturallySpeaking that is a speech-to-text program and its usefulness in learning persuasive writing. Persuasive writing is based on the Ontario elementary writing curriculum for Grade 5 and will be important in the Grade 6 EQAO assessment. The EQAO Assessment is a province wide test given to students in grades 3 and 6. The EQAO tests give parents, teachers, principals and school boards information about how well students have learned the Ontario curriculum in reading, writing and mathematics.

2. Purpose of the Letter

The purpose of this letter is to provide you with information required for you to make an informed decision about whether your child may participate in this research.

3. Purpose of this Study

The purpose of this study is to learn about how using a software program such as Dragon NaturallySpeaking, may affect student learning in of a writing genre, in this case: persuasive writing.

4. Inclusion Criteria

All students in the Thames Valley District School Board or London District Catholic School Board, in a Grade 5 class are eligible to participate in this study.

5. Exclusion Criteria

No students will be excluded from this study.

6. Study Procedures

If you agree that your child may participate, she or he will be randomly assigned to one of two writing conditions. Either they will use the software Dragon NaturallySpeaking or use pen and paper for all of the writing activities. Dragon NaturallySpeaking is speech-to-text software that allows you to use your voice to type. All of the students will be taught how to use Dragon NaturallySpeaking so that they can all benefit from this instruction. Over the course of the research, all students will be taught how to develop effective persuasive writing techniques. First, all students will complete four training sessions, each 30-45 minutes in length, on Dragon NaturallySpeaking, in which they will learn to use the software and practice using it. Following this, students will be asked to write using persuasive writing as an initial sample of their writing. Then, they will participate in four teaching periods of 30-40 minutes with their classroom teacher, to learn persuasive writing. Following all of this instruction, students will complete two more brief writing activities to assess how much they have learned. The tasks will be conducted in the students' regular classroom or in the computer lab for access to the software. The study will include about 25 students in this school, and about 50 students in total. The study will take place at a time of the teacher's choosing, when it is appropriate for the class to begin a unit on persuasive writing. Also, if your child consents to participate, the teacher will be asked to provide the child's most recent writing grade. If you do not agree that your child may participate, then the child will receive the same instruction, read the same materials and complete a similar writing activity. However, the student's writing and previous writing grade will not be used as data for this study.

7. Possible Risks and Harms

There are no known or anticipated risks or discomforts associated with participating in this study. The students' grade on the quiz will not affect his or her report card grade.

8. Possible Benefits

The possible benefit to society may be the knowledge of effective interventions in aiding students with the writing process especially for genres that are typically difficult.

9. Compensation

Your child will not be compensated for participation in this research.

10. Voluntary Participation

Participation in this study is voluntary. Your child may refuse to participate, refuse to answer any questions or withdraw from the study at any time with no effect on his or her future education.

11. Confidentiality

All writing samples that are collected will remain confidential and accessible only to the investigator of this study. While we will do our best to protect your child's information there is no guarantee that we will be able to do so. The data from our study will be made available to other researchers if requested, but no personal information, such as your child's name, initials or birth date, will be included. Other researchers may request to see the data by email. If you choose to withdraw your child from this study, or he or she chooses to withdraw, his or her data will be removed from our database and destroyed. If the results are published, your child's name will not be used. Representatives of The University of Western Ontario Non-Medical Research Ethics Board may contact you or require access to your child's study-related records to monitor the conduct of the research.

12. Contacts for Further Information

If you require any further information regarding this research project or your child's participation in the study you may contact

If you have any questions about your child's rights as a research participant or the conduct of this study, you may contact

13. Publication

If the results of the study are published, your child's name will not be used. If you would like to receive a copy of any potential study results, please contact

14. Consent

Your child may participate in the study if he or she completes the attached letter of assent, and you sign the attached parental consent form.

This letter is yours to keep for future reference.

Consent Form

Project Title: The Effect of Speech-to-Text Technology on Learning a New Writing Strategy

Study Investigator's Name: Katrina Haug

I have read the Letter of Information, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Child's Name: (if applicable) _____

Date: _____

Parent / Legal Guardian / Legally Authorized Representative (if applicable) Print: _____

Parent / Legal Guardian / Legally Authorized Representative (if applicable) Sign: _____

Parent / Legal Guardian / Legally Authorized Representative (if applicable) Date: _____

Person Obtaining Informed Consent (please print): _____

Signature: _____

Date: _____

Appendix B

Assent Letter



Project Title: The Effect of Speech-to-Text Technology on Learning a New Writing Strategy

Principal Investigator: Katrina Haug, Faculty of Education, Western University

Assent Letter

1. Why we are here.

Ms. Haug wants to tell you about a study that will look at students' writing arguments. She wants to see if you would like to be in this study.

2. Why are they doing this study?

Ms. Haug is doing this study because she wants to see how students learn about a new writing style like persuasive writing.

3. What will happen to you?

All students in the class will be talking and writing about different topics like "Should students have cell phones in class?" If you want to be in the study three things will happen:

Ms. Haug will collect your written work and keep a copy of it for the study.

Ms. Haug will use the score from your work for her study.

Your teacher will be asked to tell her your last writing grade.

If you choose not to be in the study, the teacher will give you a reading and writing activity that is like this one, but Ms. Haug will not use your work or mark in her study.

4. Will there be any tests?

There will be no tests, only writing activities and your mark on these activities will not be on your report card.

5. Will the study help you?

Whether you participate in this study or not, you will be learning about persuasive writing.

6. What if you have any questions?

You can ask questions at any time, now or later. You can talk to the teachers, your family or someone else.

7. Do you have to be in the study?

You do not have to be in the study. No one will be mad at you if you do not want to do this. If you do not want to be in the study, just say so. Even if you say yes, you can change your mind later. It is up to you. If you decide not to be in the study, and your teacher gives students a writing activity or quiz like the ones that I give students, then your quizzes and writing will not be used in the study.

I want to participate in this study.

Print Name of Child _____

Date _____

Signature of Child _____

Signature of Person Obtaining Consent

Age _____

Appendix C

Introduction to Dragon NaturallySpeaking

Lesson Plan 1: Introduction to Dragon NaturallySpeaking

Researcher: Katrina Haug, MA, Faculty of Education

Date: TBD

Time: TBD

Duration: 30 - 40 mins

Lesson Topic: Introduction to Dragon NaturallySpeaking

SPECIFIC EXPECTATION:

By the end of the lesson, students will be able to:

Train Dragon to recognize their voices and learn how to open a file, save a file and create an account with Dragon NaturallySpeaking.

MATERIALS:

Training the Dragon Tip Sheet

Computer equipped with Dragon NaturallySpeaking

Microphone headset

Projector

PROCEDURE:

Introduction: ~5 mins

Hi, my name is Miss Haug and today I am going to help you learn how to use a program on the computer called Dragon NaturallySpeaking. Dragon NaturallySpeaking lets you talk while it does the typing. You have to speak into the microphone very clearly and Dragon NaturallySpeaking will type out what you say. Today, we will work with Dragon so that it can understand your speech.

Lesson: ~20-30 mins

Use a projector with a computer so that students can see the steps that you are taking and will be able to follow along. If a projector is unavailable, the researcher will provide one to you.

Instruct students: *Please open Dragon NaturallySpeaking and Microsoft Word on your computer. Then on Dragon choose to create a new profile and fill in your first name, last initial, age and first language. I will do an example for you.*

Model the following steps with the students using a computer and projector:

(a) Launch Dragon > **Profile Creation** (Or, choose **New Profile** in the Dragon Bar Profile menu)

(b) Inform students: *When it asks you to choose a microphone type, please pick the one that says: MIC-IN-JACK SPEECH DEVICE.*

(c) **Check Microphone:** In this step, Dragon will adjust the volume to understand the students'

THE EFFECT OF SPEECH-TO-TEXT SOFTWARE ON LEARNING A NEW WRITING STRATEGY

voice. The microphone's listening side must face the corner of the students' mouth (not the front) about an inch away. It must not touch the student's hair or catch breathing sounds.

Explain this step to students: *Dragon needs to listen to you read aloud but please speak clearly. Please speak into the microphone as if you are talking to a friend at recess. Press **start volume check** once your headphones are on and read the text until you hear a beep, when you hear a beep it means Dragon does not need you to read anymore. When you are done raise your hand.*

(d) Next Click **Start Volume Check for the Quality Check**. This stage is similar to the one previously completed. Explain to the students: *Just as before, while you are reading, the computer will change your microphone volume and then it will beep which means that you are done this part. If you do not hear the beep, start reading again, from the beginning until you do hear the beep. Raise your hand when you are done.*

(e) Click **Next** when audio quality check indicates: PASSED or ACCEPTABLE. Explain to students: *In this next activity, you will need to read to Dragon for a longer period of time. This activity may take you 10 minutes, so take your time and be patient with Dragon. Before we get started with reading, let's go over some tips to help you when speaking to Dragon.*

- The researcher will hand out the Training the Dragon tip sheet and explain to the student: *This tip sheet will give you reminders and tips when using Dragon NaturallySpeaking*
- Read through the tip sheet with the students and offer to clarify any questions they may have.

(f) Choose **Show Text with Prompting**. Instruct students: *Please choose the option that says to show text with prompting. This will tell Dragon to highlight the words as you read them. This will help you keep track of where you are. Once you have selected this press Next.*

(g) Click **Next** to get to the Read Training Text screen. *This screen will have a long story for you to read out loud and this will be one of the last steps in the training.*

(h) Click **Select Text** and choose a text from Reading for Children or Easier Reading: Instructional and click **OK**.

After you click, next you are going to have select a text to read, please do so from the Reading for children category or the Easier Reading Instructional. Raise your hand if you need help with this step.

(i) Click **Next** to start reading. Explain to the student: *After you click next, you can read the sentences aloud. The words will turn gray once the computer has heard them, but there is no need to wait for this to happen; just speak like you normally do and if the computer needs to hear you re-read something, a yellow arrow will show you where to start. Remember to be patient and speak clearly.*

(j) Click **OK** on the popup screen: "Congratulations! You have finished training..." Explain to

students: *Great job! Dragon NaturallySpeaking now recognizes your voice!*

Note: Saving the user profile may take a couple of minutes.

(k) On the "Let Dragon Search for Words" screen have students uncheck the options **Search through Emails** and **My Documents**.

(p) Instruct students to click **Next** on the screen "Automatically Improve Accuracy"

(q) On the "Help Us Improve" Screen have students check off the box that says: "**Don't run data collection**"

Considerations:

If the student is having difficulty reading the text provided by Dragon NaturallySpeaking, then the researcher will turn off the student's microphone and rehearse the text with them.

Lesson Plan 2: Dragon NaturallySpeaking Activity A

Researcher: Katrina Haug, MA, Faculty of Education

Date: TBD

Time: TBD

Duration: 20 - 30 mins

Lesson Topic: Activity for Dragon NaturallySpeaking

SPECIFIC EXPECTATION:

Students will practice speaking fluently to Dragon and learning how to insert punctuation and correct a mistaken word.

MATERIALS:

Training the Dragon Tip Sheet

Computer equipped with Dragon NaturallySpeaking

Microphone headset

Dragon Activity A worksheet

PROCEDURE:

Introduction: ~5 mins

The following activity will be completed to help students familiarize themselves with the Dragon NaturallySpeaking technology. Tell students: *Today, we are going to practice using Dragon NaturallySpeaking with a short activity. Try to use your Dragon Tip Sheet to help you. If you need help opening the program or forget how to do something, please raise your hand! For this activity please read the story into the microphone to practice speaking to Dragon. Before you begin, we will review the Dragon Tip Sheet, please turn to that page in your workbook.*

Beginning Activity: ~5 mins

Have student volunteers raise their hands and read the tip sheet to remind the class of how to talk to Dragon. After you have read the tip sheet, ask students to go through each tip and use it on Dragon. For example, say the following to Dragon: *Puppy!* As they are doing this walk around to help students that may be struggling. If they have any questions about how to get started with a sentence or insert punctuation or correct an error that is not clear on the tip sheet, ask them to raise their hand.

Activity: ~10 mins

Have students find the Dragon Activity A worksheet in their workbooks. They will read the story found on this worksheet in order to gain experience using the software and understanding how it recognizes their voice. Tell students: *Please turn to the Dragon Activity A sheet in your workbooks. Using the tip sheet for help, read this story aloud to Dragon. While you are reading make sure you pay attention to capital letters and punctuation marks. You will need to tell Dragon to add them to the text as you go. When you are, done save the file and raise your hand!*

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Considerations:

Assist students with logging on to their user profile and getting the program started, as this will only be their second time doing so. Encourage them to try to do as much of it as possible on their own.

The page is decorated with black paw print icons. There are seven paw prints in a horizontal row at the top. A large, faint paw print is centered in the background. The page is framed by a border of paw prints: one on the left side, one on the right side, and a row of seven at the bottom.

Dragon Activity A

Please read the following poem aloud using Dragon NaturallySpeaking. Make sure that you also dictate the correct grammar as see in the story below (like commas and capital letters).

Raccoon Rex by Ruth Donnelly

I walk by night, in darkness.

I sneak without a sound.

I overturn the garbage can.

Oh! What a treat I've found!

I grab the picnic sandwiches.

(I haven't yet been seen.)

I take my bounty to the brook,

And wash it squeaky clean.

I creep up to the campers' tent

And snatch a hot dog bun.

The campers yell. They scream and shout.

But I'm just having fun!

A mask of fur around my eyes,

A smile upon my face,

My paws can open garbage cans.

I move with stealth and grace.

I steal from people's garden plots,

From porches and from decks.

Yes, I'm a fearless bandit--

And my name is Raccoon Rex!

Lesson Plan 3: Dragon NaturallySpeaking Activity B

Researcher: Katrina Haug, MA, Faculty of Education

Date: TBD

Time: TBD

Duration: 20-30 mins

Lesson Topic: Activity for Dragon NaturallySpeaking

SPECIFIC EXPECTATION:

Students will gain additional experience in using the Dragon NaturallySpeaking software they will practice finishing sentences and speaking their thoughts instead of writing.

MATERIALS:

Training the Dragon Tip Sheet

Computer equipped with Dragon NaturallySpeaking

Microphone headset

Dragon Activity C worksheet

PROCEDURE:

Introduction: ~5 mins

The following activity will be completed to help students familiarize themselves with the Dragon NaturallySpeaking technology. Tell students: *Today, we are going to practice using Dragon NaturallySpeaking with a small activity. Try to use your Dragon Tip Sheet to help you, we will review it before you get started. If you need help opening the program or forget how to do something, please raise your hand! For this activity, you are going to fill in the blanks with your own ideas.*

Beginning Activity: ~5 mins

Have student volunteers raise their hands and read the tip sheet to remind the class of how to talk to Dragon. Ask students if they have any questions about the Tip Sheet.

Activity: ~10 mins

Have students find the Dragon Activity B worksheet in their workbooks. They will read the sentences to Dragon and then fill in the blanks with their own ideas. Tell students: *Please read the sentences to Dragon. Where there is a blank fill it in with your own idea, for example "My favourite season is summer because swimming is my favourite sport and it is a lot more fun to swim when it is warm outside."*

Considerations:

Assist students with logging on to their user profile and getting the program started, as this will only be their second time doing so. Encourage them to try to do as much of it as possible on their own.



Dragon Activity B

Using Dragon NaturallySpeaking please read the sentences and fill in the blanks with your own ideas.

My name is _____.

*My favourite flavour of ice cream is _____ and
if I could eat one thing for the rest of my life, it
would be _____.*

*My favourite animal is _____, I like this
animal better than _____ because _____.*

*My favourite season is _____, because
_____.*

*On a rainy day I like to _____ . If I
could go anywhere in the world, I would go to
_____ because _____.*

My favourite thing to do is _____ !

Lesson Plan 4: Dragon NaturallySpeaking Activity C

Researcher: Katrina Haug, MA, Faculty of Education

Date: TBD

Time: TBD

Duration: 20-30 mins

Lesson Topic: Activity for Dragon NaturallySpeaking

SPECIFIC EXPECTATION:

Students will gain additional experience in using the Dragon NaturallySpeaking software.

MATERIALS:

Training the Dragon Tip Sheet

Computer equipped with Dragon NaturallySpeaking

Microphone headset

Dragon Activity B worksheet

PROCEDURE:

Introduction: ~5 mins

The following activity will be completed to help students familiarize themselves with using Dragon NaturallySpeaking to compose text answering a specific question. Tell students: *Today, we are going to practice using Dragon NaturallySpeaking with a small activity. Try to use your Dragon Tip Sheet to help you. If you need help opening the program or forget how to do something, please raise your hand! For this activity, you are going to answer the question: If you could plan the best day ever what would you do? Please make sure you have at least 5 sentences.*

Beginning Activity: ~5 mins

Have student volunteers raise their hands and read the tip sheet to remind the class of how to talk to Dragon.

Then ask students to pair with a partner and discuss the question: *If you could plan the best day ever what would you do?* For approximately 5 minutes to get some ideas before working on the assignment.

Activity: ~10 mins

Have students find the Dragon Activity B worksheet in their workbooks. They will dictate their answer to the following question: *If it you could plan the best day ever what would you do?*

Considerations:


Assist students with logging on to their user profile and getting the program started, as this will only be their second time doing so. Encourage them to try to do as much of it as possible on their own.




Dragon Activity C

Please read this short text and then answer the question with your own ideas!

Try to have at least 5 sentences and remember to use Dragon NaturallySpeaking when you answer the question.



If I could plan my perfect day, I would do many different things. First, I would make sure that the weather was warm and sunny and that my friends and family could all come with me. Then I would spend some time flying around the world in a super fast airplane and visit many different beaches. While at the beach, I would try all of the different water sports like swimming, kayaking, snorkeling, and surfing. I would make sure that we could see a family of dolphins and go swimming with them in the ocean. The end of my best day ever would be a giant dinner of all different kinds of seafood on the beach while the sunsets.



If you could plan the best day ever what would you do?





Training the Dragon Tip Sheet

Before you start...

**Make sure you click on your word document
before you start speaking.**

Say the following key words into Dragon to help it understand what you want it to do:

Say this...	...to make Dragon to this
"New line or New Paragraph"	This will start a new paragraph.
"Microphone Off"	This will turn off your microphone. <i>When you are finished telling Dragon your ideas make sure you say this.</i>
"Correct That"	This will delete the last thing that you said.
"Period"	To place a "."
"Exclamation mark"	To place a "!"
"Comma"	To place a ","
"Question Mark"	To place a "?"

Appendix D

Pre-Test and Post-Test Questions

1. Imagine that your school was thinking about having school uniforms or if they already have school uniforms, they were thinking of getting rid of them. Write at least one page about what you think the school should do about uniforms.
2. Imagine you are transported 100 years into the future; do you think that the world would be a better or worse place? Try to write at least one page.
3. Imagine you are writing a letter to your parents about watching TV. In about one page, answer the question: Do you think that children should be able to choose what they watch on TV?

Pre-test and Post-test questions will appear in the following format for students:



Name: _____

Writing Assignment

Please answer the following question using the space provided.

Imagine that your school was thinking about having school uniforms or if they already have school uniforms, they were thinking of getting rid of them. Write at least one page about what you think the school should do about uniforms.

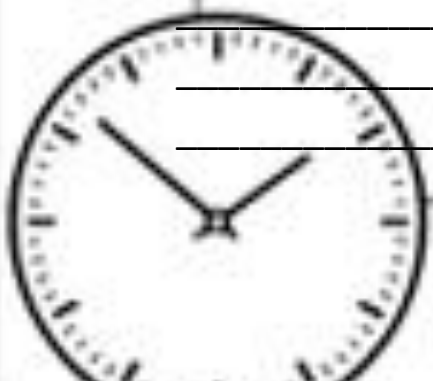


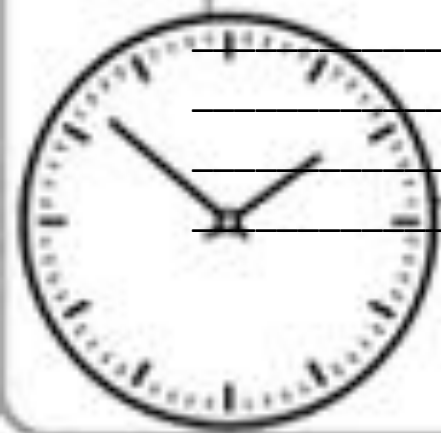
Name: _____

Writing Assignment

Imagine you are transported 100 years into the future; do you think that the world would be a better or worse place? Try to write at least one page.







Name: _____

Writing Assignment

Imagine you are writing a letter to your parents about watching TV. In about one page, answer the question: Do you think that children should be able to choose what they watch on TV?

Appendix E

Lesson 1 - Developing Reasons

Researcher: Katrina Haug

Subject: Persuasive Writing

Date: TBD

Duration: 30 -45 mins

Lesson Topic: Opinion and Reasons

Grade/Class: 5

Time: TBD

CURRICULUM EXPECTATIONS:

The expectations for the following four lessons on persuasive writing fulfill expectations 1.1, 2.1, 2.5 and 4.1 of the Ontario Ministry of Education Curriculum for Grade 5 in Writing.

SPECIFIC EXPECTATION:

By the end of the lesson, students should/will be able to:

Identify their point of view and opinion on an issue as well as provide a minimum of three supporting reasons to back up their opinion.

MATERIALS:

- Comparing arguments worksheet to be used with Smart Board.
- Assignment Question: *Imagine that your principal said the school would start selling candy if you write the office a letter to convince them, which type of candy they should sell (which candy is the best). Try to write at least one page. To complete either orally or in writing depending on treatment condition.*

PROCEDURE:

Introduction: ~5 mins

- Start by explaining persuasive writing in general: "Throughout the next four lessons we are going to learn about persuasive writing, this type of writing is used to convince the reader and your audience that the writer's opinion on a topic is correct."
- Introduce the topic of today's lesson, which is to: *Today we are going to learn that it is important to give your opinion of a problem or issue at the beginning of your paper so that the reader will know what you are writing about. For example if the question was: Which flavour of ice cream is best? You would start by saying your opinion like: I believe that strawberry is the best flavour of ice cream.*

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- Explain that: *When you write your opinion, like: I believe that summer is the best season for many different reasons, this is called your topic sentence in argument writing.*
- Explain that: *However, you cannot just leave it at that, you have to give reasons and try to give at least 3 different reasons to support your opinion. Having reasons helps to make a stronger argument, without good, convincing reasons it is hard for the reader to understand why you think the way that you do and they cannot decide if they agree with you or not. For example, for our question about ice cream, you could say: I believe that strawberry ice cream is the best flavour of ice cream. This is true because strawberry ice cream is made from fruit so it always tastes delicious. Another reason why I think strawberry ice cream is the best is because it is pink and that is my favourite colour.*

Beginning Activity: ~5-10 mins

Set up the following on the chalk/white board:

Winter is the best season.

Why?

- Instruct students to go up to the board and write reasons that winter could be the best season.
- Then the teacher will read through all of the different reasons with the class and encourage complex reasons, for example: if a student said, "winter is nice," the teacher will respond with asking, "What makes winter nice?" to help the class think of ways to write better reasons with more detail because they will be more convincing.

Activity: ~5-10 mins

- Think, Pair, Share: Students will read both of the attached texts then with a partner they will discuss the texts and which one is more convincing and why. Finally, they will share their ideas with the entire class.
- Students should discover that although both have a topic sentence and reasons, Example 2 has a greater number of reasons that are more detailed and this makes the argument more convincing.

Assignment: ~15 mins

- Have students find the worksheet in their workbooks titled Argument Writing Assignment #1

THE EFFECT OF SPEECH-TO-TEXT SOFTWARE ON LEARNING A NEW WRITING STRATEGY

- Go over the assignment and ask the students: Q: *What are you going to remember to do first?* A: *Give an opinion*, Q: *Next, you will give as many reasons as you can, why do you give reasons?* A: *To make an argument convincing.*
- Tell students: *The "Checklist" at the top of your assignment is a guide to help you remember the parts of the argument that we have learned so far that you should include in your writing. For example, after you give your opinion check that off in the checklist.*
- Before starting to write, have students spend approximately 3-4 minutes looking over the checklist and memorizing it. Then instruct students to close their books and find a partner. They will take turns with their partner reciting the steps in the checklist to help them remember.
- Students will be given 15-20 minutes to complete this assignment either written or oral depending on the treatment condition.
- Their written work will be collected by the researcher upon completion and the students will be provided with feedback. The researcher will mark up the text with comments for the parts of the argument that the student is missing, and use checkmarks to indicate all the parts that they included.

Considerations:

If students are having difficulty getting started with the writing assignment then the teacher may provide sentence starters to the student such as: "My opinion is..." or "One reason for this is..." In providing only sentence starters, it ensures that the ideas belong to the student.



Comparing Arguments

Is it better to live in the city or the country?

Example #1:

I think it is better to live in the country than the city. First, country living is fun because you can play in the fields and woods and you have lots of room. Second, when you live in the country you get to work with the animals.

Example #2:



In my opinion, it is better to live in the city. For one, when you live in the city you are close to everything and do not have to travel long distances to go to the store. My second reason for living in the city is that when you live in the city you are close by to your friend's houses so you can walk or bike to hang out with your friends instead of having to ask your parents to drive you. Another good reason for living in the city is that the city is big and there are so many different things that you can do so you will never be bored like you would be in the country. My final reason that the city is better than the country is that in the city people live close together and there are many people so you have the chance to always meet new people and make new friends.

Name: _____

Argument Writing Assignment #1

Checklist:

- Write your opinion
- At least three reasons to support opinion

Imagine that your principal said the school would start selling candy if you write the office a letter to convince them, which type of candy they should sell (which candy is the best). Try to write at least one page.

Appendix F

Lesson 2 - Different Opinion

Researcher: Katrina Haug

Subject: Persuasive Writing

Date: TBD

Duration: ~ 30 mins

Lesson Topic: Different Opinion

Grade/Class: 5

Time: TBD

CURRICULUM EXPECTATIONS:

The expectations for the following four lessons on persuasive writing fulfill expectations 1.1, 2.1, 2.5 and 4.1 of the Ontario Ministry of Education Curriculum for Grade 5 in Writing.

SPECIFIC EXPECTATION:

By the end of the lesson, students should/will be able to:

Understand that there is an opinion different from their own. They will be able to identify that opinion and come up with some reasons someone may have for that opinion.

MATERIALS:

- Comparing arguments worksheet to be used with Smart Board. Question 1 is complete while Question 2 is missing vital components.
- Assignment worksheet: *Imagine your parents asked you "Do you think that you should have to clean your room? Try to write one page to convince them of your opinion on cleaning your room. To complete either orally or written depending on treatment condition.*

PROCEDURE:

Introduction: ~3-5 mins

- Remind students about the content of the previous lesson: that the topic sentence in argument writing expresses their opinion and that reasons help to make a stronger argument. Without good, convincing reasons it is hard to persuade the reader and is difficult for the reader to understand your opinion.
- Introduce the topic of today's lesson, which is: *"Today we are going to learn that it is important to think about the other opinion. Someone might have an opinion different from yours. This is the other side of the argument. They may have reasons for their opinion. It is important to include this in your writing because there are always two sides to a problem or argument. When you write about the other opinion you:*

- *let the reader know you have thought about both sides*
- *but you show them that you agree more with one side"*

Beginning Activity: ~5 mins

- Model and Explain: Using the attached text with the smart board (Comparing Arguments Example 1), read the text with the class and point out the parts of the text including the writer's opinion, reasons for their opinion and the other opinion and the reasons for that opinion. Ask students: *Why is it important to include the other opinion?*
- Explain that: *"although the goal of persuasive writing is to convince the reader of your opinion it is important to include the other opinion different from yours because it will show the reader you have thought about the other opinion.."*

Activity: ~7 - 10 mins

- Model and Explain: Using the attached text with the smart board (Example 1), read the text with the class and point out the parts of the text including the writer's opinion, reasons for their opinion and the other opinion and the reasons for that opinion. Ask students: *Why is it important to include the other opinion?* Explain that: *even though the goal is to persuade your audience to agree with your opinion it will make your argument stronger if you include the other side of the issue and reasons that someone may support an opinion different from yours.*
- Think, Pair, Share: Students will work with a partner and read the text in their workbook (attached as Example 2). This text is incomplete and does not contain the other side of the issue or reasons for that opinion.
Ask students to work with their partner to identify the parts of the argument in the text such as: the writer's opinion, and a reason
Then ask students to work with their partner again but this time, add the missing part of the text. That is to fill in the other side of the issue and then add some possible reasons someone may have to support that side.
- Finally, each group will share how they fixed the text with the class.

Assignment: ~15 mins

- Have students find the worksheet called Argument Writing Assignment #2 with the question: *"Do you think children should have to clean their rooms?"*
- Go over the assignment and remind students of the task by asking questions such as: Q: *What are you going to remember to do first?* A: *Give an opinion,* Q: *Next, you will give as many reasons as you can, why do you give reasons?* A: *To make an argument convincing.*
- Remind students that the checklist at the top of the page is a guide to help them remember all of the elements of the argument to include in their text.

THE EFFECT OF SPEECH-TO-TEXT SOFTWARE ON LEARNING A NEW WRITING STRATEGY

- Before starting to write, have students spend approximately 3-4 minutes looking over the checklist and memorizing it. Then instruct students to close their books and find a partner. They will take turns with their partner reciting the steps in the checklist to help them remember
- Students will be given approximately 15 minutes to complete this assignment either written or oral depending on the treatment condition.
- Students' written work will be collected by the researcher upon completion and the students will be provided with feedback. The researcher will mark up the text with comments for the parts of the argument that the student is missing, and use checkmarks to indicate all the parts that they included.

Considerations:

If students are having difficulty getting started with the writing assignment, then the teacher may provide sentence starters to the student such as: "Other people may think..." or "Someone else might think that..." In providing only sentence starters, it ensures that the ideas belong to the student.



Comparing Arguments



Example #1

Should children have to go outside for recess?

I think that everyone should have to go outside for recess. One reason why everyone should go outside is that children need exercise. A second reason that everyone should go outside for recess is that it is hard to sit in one place all day and recess gives kids a break from this. Another good reason for going outside is that you get to meet kids from different grades and classes and make new friends. My last important reason for why children should go outside for recess is that they get to play and learn new sports. Other people could think that recess is not fun. They might think this way because they might not like it when it is really hot or really cold outside, so they would prefer to stay indoors. They also may not think that recess is fun because they prefer to read books or play games then to play sports and most of the time recess is best for sports.



Comparing Arguments



Example #2

Should children have to go outside for recess?

In my opinion, kids should be able to choose if they want to go outside for recess. Some kids do not like to play sports and would prefer to finish their homework or read a book, which is much more comfortable to do when you are inside. Another reason why it should be the kid's choice is that recess is supposed to be time for kids to relax and have a break from the school day, so they should get to choose how they want to spend that time. Some people might not agree and say that all kids should go outside, but I think that it should be a choice.

Name: _____

Argument Writing Assignment #2

Checklist:

- Write your opinion
- At least three reasons to support opinion
- Other side of the argument
- Reasons for the other side of the argument

Imagine your parents asked you "Do you think that you should have to clean your room?" Try to write one page to convince them of your opinion on cleaning your room.

Appendix G

Lesson 3 - Rebutting the Other Side

Researcher: Katrina Haug

Subject: Persuasive Writing

Date: TBD

Duration: 25 - 30 mins

Lesson Topic: Rebutting the other opinion

Grade/Class: 5

Time: TBD

CURRICULUM EXPECTATIONS:

The expectations for the following four lessons on persuasive writing fulfill expectations 1.1, 2.1, 2.5 and 4.1 of the Ontario Ministry of Education Curriculum for Grade 5 in Writing.

SPECIFIC EXPECTATION:

By the end of the lesson, students should/will be able to:

To write a rebuttal against the other opinion.

MATERIALS:

- Assignment Question: *Imagine you are writing to your parents about getting money for your good grades on your report card. Do you think that parents should pay their children for getting good grades? Try to write one page of your opinion on this topic. To complete either orally or written depending on treatment condition.*
- Ziploc bag of a cut up persuasive text to be reassembled by students.
- Review Text

PROCEDURE:

Introduction: ~5 mins

- Remind students about the content of the previous lesson by using the attached "Review Text" which is a text that was looked at in the previous lesson. Point to each part of the text as you mention the following:
"The topic sentence in argument writing expresses their opinion and reasons help to make a stronger argument. Without good, convincing reasons it is hard to persuade the reader and is difficult for the reader to understand your opinion. Also, it is important to state the other side of the argument and reasons someone may believe the other side. This is important to include because it will help you to write a stronger argument."
- Introduce the topic of today's lesson, which is: to provide a rebuttal.

"Today we are going to work on adding a rebuttal to our arguments. After you write about the other side of the argument, as we practiced in the last lesson, it is important to add a rebuttal. The rebuttal will be your chance to argue back and to convince the readers of your opinion on the issue which makes your argument stronger."

- Explain to students that: *A good rebuttal will respond right to the counter argument. So if someone said that they hate broccoli because it has a bad taste a rebuttal to this could be: It is true that some people do not like broccoli because of its taste. However, it does not have to taste bad, you could cook it different ways in different sauces and spices to change its flavour.*

Beginning Activity: ~5-10 mins

- Introduce the activity, which will be to assemble the parts of the essay in order.
- Before they begin, remind students that the parts of the argument in order are: give opinion, reasons for that opinion, different opinion, reasons for the different opinion and rebuttal.
- Have students work in pairs and pass out the Ziploc bag of the cut up argument.
- Instruct students to work together to assemble the argument in order keeping in mind the different parts of a persuasive argument that we have already learned.
- Using the smart board, go over the correct order of the argument.

Activity: ~5 mins

- Think, Pair, Share: Students will work with a partner and read the argument in their workbooks that is called "Do you think that children should be allowed to choose their own bed time?" This text is missing a rebuttal.
- Have students work with their partner to fill in the missing part of the text, the rebuttal.
- Then they will share their answers with the class.

Assignment: ~15 mins

- Have students find the worksheet in their workbooks called Argument Writing Assignment #3 with the question: *"Should parents give their children money for getting good grades on their report cards?"*
- Remind students that the checklist at the top of the page is a guide to help them remember all of the elements of the argument to include in their text.
- Before starting to write, have students spend approximately 1 minute looking over the checklist and memorizing it. Then instruct students to close their books and find a partner. They will take turns with their partner reciting the steps in the checklist to help them remember

THE EFFECT OF SPEECH-TO-TEXT SOFTWARE ON LEARNING A NEW WRITING STRATEGY

- Students will be given 15-20 minutes to complete this assignment either written or oral depending on the treatment condition.
- Students' written work will be collected by the researcher upon completion and the students will be provided with feedback. The researcher will mark up the text with checkmarks for the elements that are there and write a comment on the text for elements that are missing.

Considerations:

If students are having difficulty getting started with the writing assignment then the teacher may provide sentence starters to the student such as: "This could be true but..."or "That is possible but..."In providing only sentence starters, it ensures that the ideas belong to the student.



Mix-Up Activity



The following text will be cut into pieces; students will work in groups of 3-4 to try to assemble the text in the correct order. The following is the teacher copy of the text.

Do you think that there should be zoos?

Example #1

I think that there should be zoos because you can learn a lot while having fun at the zoo.

One reason that I think there should be zoos is because they teach people about animals from around the world that they might have never seen before.

Another reason that I think zoos are important is because when the animals are kept in the zoo they are safe and will not die as they would in the wild.

This is important for animals that are endangered or becoming extinct, if they live in a zoo then humans or other animals will not hunt them and their species will not disappear from the earth.

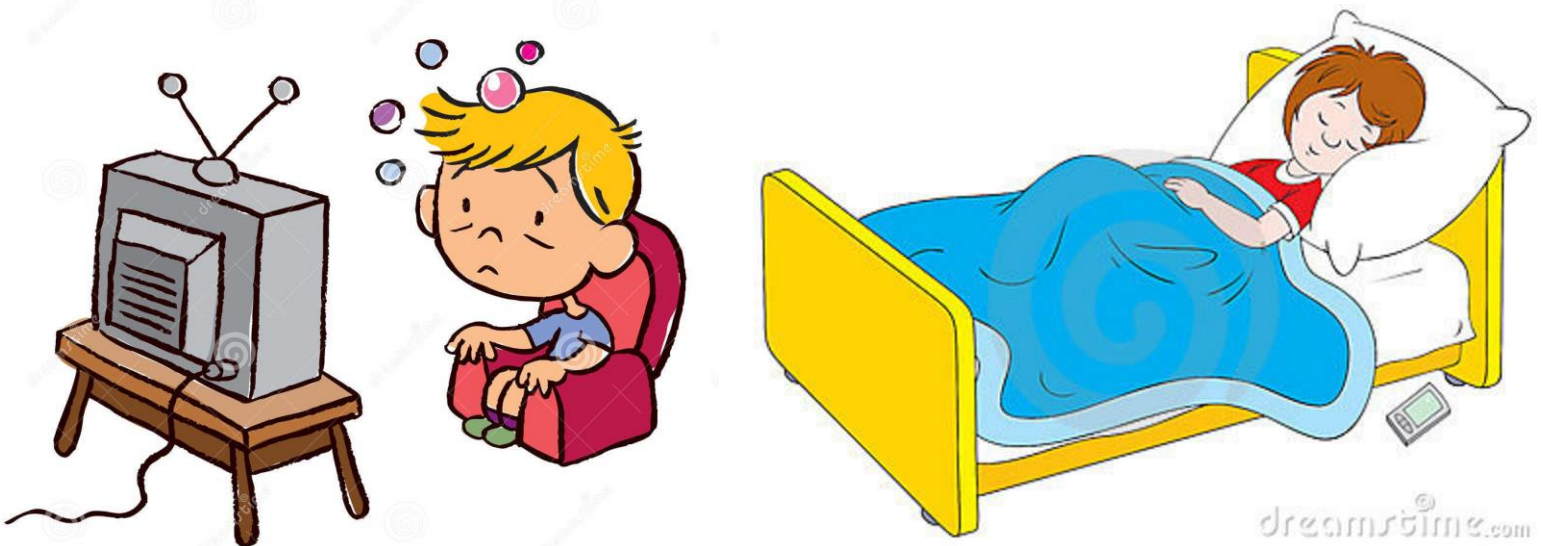
Finally, I think that zoos are a good idea because zookeepers really care about the animals; they have large areas to live in and are fed very well. In the wild, the animals might have a hard time finding food or not have a nice, safe place to live as they do in the zoo.

Some people think that there should not be any zoos because animals do not have enough room to live in a zoo.

This might be true of some zoos, but newer zoos actually give animals lots of space to live and move around in.

Do You Think That Children Should be Allowed to Choose Their Own Bed Time?

In my opinion, I do not think that children should be allowed to choose their own bedtime. If kids could choose their own bedtime then they would always be tired and never go to bed. They would get in trouble at school for falling asleep and would probably get a bad mark in their classes because they would always be too tired for activities. In addition, sleep is important to keep you healthy so kids who always tried to stay up late and not get a good night's sleep may get sick too. Some people might think that kids should choose their own bedtime because they would say that it is your own body and only you know when you are tired.



Name: _____

Argument Writing Assignment #3

Checklist:

- Write your opinion
- At least three reasons to support opinion
- Other side of the argument
- Reasons for the other side of the argument
- Clear rebuttal

Imagine you are writing to your parents on the topic of getting money for good grades on report cards. Do you think that parents should pay their children for getting good grades? Try to write one page of your opinion on this topic.

Appendix H

Lesson 4 - Conclusion

Researcher: Katrina Haug

Subject: Persuasive Writing

Date: TBD

Duration: 25 - 30 mins

Lesson Topic: Conclusion

Grade/Class: 5

Time: TBD

CURRICULUM EXPECTATIONS:

The expectations for the following four lessons on persuasive writing fulfill expectations 1.1, 2.1, 2.5 and 4.1 of the Ontario Ministry of Education Curriculum for Grade 5 in Writing.

SPECIFIC EXPECTATION:

By the end of the lesson, students should/will be able to:

Correctly integrate a concluding statement that includes a restatement of opinion and a call to action into their writing and to understand the purpose of having a concluding statement.

MATERIALS:

- Comparing arguments worksheet to be used with Smart Board. Argument 1 is complete while Argument 2 is missing vital components.
- "Review of Persuasive Writing" text
- Examples of Grade 5 persuasive texts with and without conclusions
- Assignment Question: *Imagine you could win a free airplane ticket to any place in the world. All you have to do is convince the airplane company of which city you thought was the best. Try to write at least one page about which city you think is the best in the world.* To complete either orally or written depending on treatment condition.

PROCEDURE:

Introduction: ~5 mins

- Introduce the topic of today's lesson, which is: *to add a conclusion to the end of the text.*
- Remind students about the content of the previous lesson by using the attached "Review Persuasive of Writing" text from last lesson about zoos with the Smart Board. While reading through this text again with the class use it to point out the components they have already learned and remind students of the following:
 - *The topic sentence in argument writing expresses their opinion*

- *Reasons help to make a stronger argument*
- *Important to include the other opinion and reasons someone may think that way.*
- *Point out that this text is missing an important part...the conclusion.*
- Explain that: *The conclusion is an ending sentence or paragraph that tells the reader that you are done and reminds them of what your original opinion was at the beginning of your writing. The conclusion is important because it reminds the reader of your reasons and tells them what you hope they will believe or what they will do, which can be called a "call to action".*

Beginning Activity: ~5-10 mins

- Model and Explain: Using the two attached texts with the smart board, read through each text with the class and have the student's point out the parts of the argument that were taught in Lesson 1-3. For Text B, highlight the conclusion and compare this to Text A that has no conclusion.

Activity: ~5-10 mins

- Students will be working with examples of grade 5 persuasive writing and the conclusions have been removed and attached to this lesson plan separately.
- Have students get into groups of 3-4 and pass out one of the three attached samples of student writing to each group.
- Instruct students: *"Read these examples of persuasive writing by other grade five students with your group. These texts are missing their conclusions, work with your group to come up with a good conclusion for the argument that this writer had."*
- After students have come up with a conclusion, pass out the corresponding original conclusions (i.e. conclusion "A" goes with text "A")
- Instruct students to read the original conclusion with their group and discuss what their new conclusion was missing or how it was better than the original conclusion.

Assignment: ~15 mins

- Remind students to check the prompts at the top of their assignment page to remind them what they should include in their writing.
- Have students find the worksheet in their workbook titled Argument Writing Assignment #4 with the question: *"Which city do you think is the best in the world?"*
- Students will be given 15-20 minutes to complete this assignment either in writing or orally depending on the treatment condition.
- Students' written work will be collected by the researcher upon completion and the students will be provided with feedback. The researcher will mark up the text with

checkmarks for the elements that are there and write a comment on the text for elements that are missing.

Considerations:

If students are having difficulty getting started with the writing assignment then the teacher may provide sentence starters to the student such as: "In conclusion....." or "In the end, I think that..." In providing only sentence starters, it ensures that the ideas belong to the student.

Review of Persuasive Writing

I think that there should be zoos because you can learn a lot while having fun at the zoo.

One reason that I think there should be zoos is because they teach people about animals from around the world that they might have never seen before.

Another reason that I think zoos are important is because when the animals are kept in the zoo they are safe and will not die as they would in the wild.

This is important for animals that are endangered or becoming extinct, if they live in a zoo then humans or other animals will not hunt them and their species will not disappear from the earth.

Finally, I think that zoos are a good idea because zookeepers really care about the animals; they have large areas to live in and are fed very well, in the wild the animals might have a hard time finding food or not have a nice, safe place to live as they do in the zoo.

Some people think that there should not be any zoos because animals do not have enough room to live in a zoo.

This might be true of some zoos, but newer zoos actually give animals lots of space to live and move around in.



Comparing Arguments

Which pet is the best, a cat or a dog?



Example #1

Cats and dogs can be very entertaining.

However, when it comes down to the best pet, I would say the dog is the best. One reason why I think a dog is the best pet to have is because you can talk to them and teach them tricks and they listen to you. Another reason I think a dog is the best pet is that they love to play so when you are bored and have nothing to do you can always count on your dog to play with you, which is fun and very good exercise for you, and your dog.

Some people might think that cats are better than dogs because dogs are hard to train and they could bite and really hurt someone. This can be true but it is also true for cats. If you do not know how to care for a cat, it will probably scratch you or could even bite.

Example #2

Both cats and dogs can make good pets.

However, in my opinion a cat would win as the best pet. For one, cats are very clean, they give themselves baths and you do not need to brush them. A second reason that cats are better than dogs is that cats like to be alone so they can be left alone all day while you are at school.

Some people think that dogs are better pets than cats because dogs are a lot of fun since they are so playful and since they are social, they become part of your family. This is true but it can also be true for cats. Kittens are very playful and if you play with your cat, it will probably play with you too.

For all of these reasons even though both cats and dogs are popular pets, cats would make the best pets for all different kinds of people and families. Next time you think about getting a new pet you should think about these reasons and choose to get a cat, I know you will love it!

Grade 5 Persuasive Writing Text A

I think my dad deserves an award for being the most helpful person in my life.

When I'm sad, he says funny things and tries to cheer me up. On the weekends he always does fun activities with my brother and me and doesn't make us go to bed early unless it's required. My dad is very smart, wise, and patient. He answers all my questions. Most of all, he doesn't act like my brother and I are "just kids". He doesn't expect us to know everything, but he doesn't treat us like babies.

To me, all these things are helpful. If he didn't try to cheer me up, it would be hard to get myself together. I would have very boring weekends if we never did anything and went to bed too early. If he didn't answer my questions, we would never have conversations because questions are what start them. If he treated me like a baby, it would be hard to learn how to take care of myself.

Grade 5 Persuasive Writing Conclusion A

My dad is the most helpful person
in my life and he definitely deserves
an award.

Grade 5 Persuasive Writing Text B

My mom deserves an award because she's the most helpful person to me. She helps me with my homework like spelling and reports. She also helps me study for tests by quizzing me. Sometimes she helps me with math when I have trouble.

My mom is also helpful in the morning because she sometimes makes my breakfast when I'm tired. Also my mom takes me to school on her days off. Over the weekends she takes me where I need to go.

She helps me when I have a problem at home, like if I can't reach something. She also helps me when I need her to bring something to me when I'm upstairs. Also she helps me carry something if it's too heavy.

She's also a big help because she takes me and my friends places like bowling. She also takes me mini-golfing. She buys me toys and things for school.

Grade 5 Persuasive Writing Conclusion B

All together I think my mom is pretty helpful
and I dont know about you, but I think she
deserves an award, I hope you do to!

Grade 5 Persuasive Writing Text C

I think that people should get an award because they could have saved someones life and went through all that trouble and they didn't get anything for it. If I could, I would give anyone an award helped somebody, or saved somebody's life or something like that.

I would give my mom an award for putting some kids back in their place because they were yelling at me and they haven't done it ever since. I would give an award that would be signed by the president, George bush If you do something nice, I will give you an award.

Grade 5 Persuasive Writing Conclusion C

In school we have assemblies and we get awards. I hope I convinced you enough by talking to you by giving people awards when they do something helpful to others.

Name: _____

Argument Writing Assignment #4

Checklist:

- Write your opinion
- At least three reasons to support opinion
- Other side of the argument
- Reasons for the other side of the argument
- Clear Rebuttal
- Conclusion

Imagine you could win a free airplane ticket to any place in the world. All you have to do is convince the airplane company of which city you thought was the best. Try to write at least one page about which city you think is the best in the world.

Appendix I

Student Workbook

Argument Writing Workbook



Training the Dragon Tip Sheet

Before you start...

Make sure you click on your word document before you start speaking.

Say the following key words into Dragon to help it understand what you want it to do:

Say this...	...to make Dragon to this
"New line or New Paragraph"	This will start a new paragraph.
"Microphone Off"	This will turn off your microphone. <i>When you are finished telling Dragon your ideas make sure you say this.</i>
"Correct That"	This will delete the last thing that you said.
"Period"	To place a "."
"Exclamation mark"	To place a "!"
"Comma"	To place a ","
"Question Mark"	To place a "?"



Dragon Activities!

The next few pages are activities you will use with Dragon NaturallySpeaking.

Your teacher will tell you when to complete each one.

These activities will help you to practice using Dragon and to help Dragon to recognize your voice!



Dragon Activity A



Please read this poem out loud using Dragon NaturallySpeaking. Make sure that you also say the grammar that you see in the poem to Dragon (like commas and capital letters).



Raccoon Rex by Ruth Donnelly



I walk by night, in darkness.

I sneak without a sound.

I overturn the garbage can.

Oh! What a treat I've found!

I grab the picnic sandwiches.

(I haven't yet been seen.)

I take my bounty to the brook,

And wash it squeaky clean.

I creep up to the campers' tent

And snatch a hot dog bun.

The campers yell. They scream and shout.

But I'm just having fun!

A mask of fur around my eyes,

A smile upon my face,

My paws can open garbage cans.
















I move with stealth and grace.

I steal from people's garden plots,

From porches and from decks.

Yes, I'm a fearless bandit--

And my name is Raccoon Rex!





Dragon Activity B

Using Dragon NaturallySpeaking:

Please read the sentences and fill in the blanks with your own ideas.

My name is _____.

*My favourite flavour of ice cream is _____ and
if I could eat one thing for the rest of my life, it
would be _____.*

*My favourite animal is _____, I like this
animal better than _____ because _____.*

*My favourite season is _____, because
_____.*

*On a rainy day I like to _____ . If I
could go anywhere in the world, I would go to
_____ because _____.*



My favourite thing to do is _____ !



Dragon Activity C

Please read this short text and then answer the question with your own ideas!

Try to have at least 5 sentences and remember to use Dragon NaturallySpeaking when you answer the question.



If I could plan my perfect day, I would do many different things. First, I would make sure that the weather was warm and sunny and that my friends and family could all come with me. Then I would spend some time flying around the world in a super fast airplane and visit many different beaches. While at the beach, I would try all of the different water sports like swimming, kayaking, snorkeling, and surfing. I would make sure that we could see a family of dolphins and go swimming with them in the ocean. The end of my best day ever would be a giant dinner of all different kinds of seafood on the beach while the sunsets.



If you could plan the best day ever what would you do?





Lesson #1

Opinion & Reasons

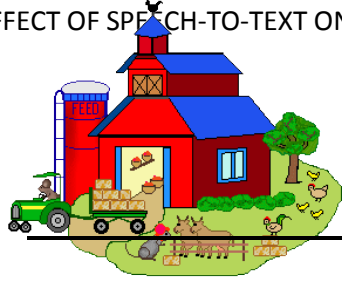
This lesson is going to teach you about how to give your opinion and support your opinion with reasons.

What you can do to make your opinion and reasons great:

- Make sure you write your opinion at the beginning
- Have convincing reasons
- Use three or more reasons to support your opinion

Example of opinion & reasons:

I think that Halloween is the best holiday. Halloween is the best holiday because you get to dress up as anything you want. Another reason that I love Halloween is because you get lots of candy and I love candy. Also, Halloween is awesome because you can be creative with all of the decorations like carving pumpkins and making your house look scary!



Comparing Arguments

Is it better to live in the city or the country?

Example #1:

I think it is better to live in the country than the city. First, country living is fun because you can play in the fields and woods and you have lots of room. Second, when you live in the country you get to work with the animals.



Example #2:

In my opinion, it is better to live in the city. For one, when you live in the city you are close to everything and do not have to travel long distances to go to the store. My second reason for living in the city is that when you live in the city you are close by to your friend's houses so you can walk or bike to hang out with your friends instead of having to ask your parents to drive you. Another good reason for living in the city is that the city is big and there are so many different things that you can do so you will never be bored like you would be in the country. My final reason that the city is better than the country is that in the city people live close together and there are many people so you have the

**chance to always meet new people and
make new friends.**

Name: _____

Argument Writing Assignment #1

Checklist:

- Write your opinion
- At least three reasons to support opinion

Imagine that your principal said the school would start selling candy if you write the office a letter to convince them, which type of candy they should sell (which candy is the best). Try to write at least one page.



THE EFFECT OF SPEECH-TO-TEXT SOFTWARE ON LEARNING A NEW WRITING STRATEGY

Please answer the next two questions while thinking about the text you just wrote.

How easy or difficult was this writing activity? Please circle a number.

1	2	3	4	5	6	7	8	9
Very very easy		Easy		Medium		Difficult		Very very difficult

How much effort did you put into this writing activity? Please circle a number.

1	2	3	4	5	6	7	8	9
Very very little effort		Little effort		Medium effort		Much effort		Very very much effort



Lesson #2

Different Opinion

This lesson is going to teach you about thinking about an opinion that is different from your own and reasons someone may have for that opinion.

What you can do to write a great different opinion

- Think about other opinions on the same topic
- Think about why someone might think this way, this will be your reasons for the different opinion
- Try to have at least 2 reasons for the other opinion

Example of different opinion is highlighted:

I think that Halloween is the best holiday. Halloween is the best holiday because you get to dress up as anything that you want. Another reason that I love Halloween is because you get lots of candy and I love candy. **Some people might say that Christmas is a better holiday because you get presents and do not have to worry about choosing a costume to wear.**



Comparing Arguments



Example #1

Should children have to go outside for recess?

I think that everyone should have to go outside for recess. One reason why everyone should go outside is that children need exercise. A second reason that everyone should go outside for recess is that it is hard to sit in one place all day and recess gives kids a break from this. Another good reason for going outside is that you get to meet kids from different grades and classes and make new friends. My last important reason for why children should go outside for recess is that they get to play and learn new sports. Other people could think that recess is not fun. They might think this way because they might not like it when it is really hot or really cold outside, so they would prefer to stay indoors. They also may not think that recess is fun because they prefer to read books or play games then to play sports and most of the time recess is best for sports.



Comparing Arguments



Example #2

Should children have to go outside for recess?

In my opinion, kids should be able to choose if they want to go outside for recess. Some kids do not like to play sports and would prefer to finish their homework or read a book, which is much more comfortable to do when you are inside. Another reason why it should be the kid's choice is that recess is supposed to be time for kids to relax and have a break from the school day, so they should get to choose how they want to spend that time. Some people might not agree and say that all kids should go outside, but I think that it should be a choice.

Name: _____

Argument Writing Assignment #2

Checklist:

- Write your opinion
- At least three reasons to support opinion
- Other side of the argument
- Reasons for the other side of the argument

Imagine your parents asked you "Do you think that you should have to clean your room?" Try to write one page to convince them of your opinion on cleaning your room.



THE EFFECT OF SPEECH-TO-TEXT SOFTWARE ON LEARNING A NEW WRITING STRATEGY

Please answer the next two questions thinking about the text you just wrote.

How easy or difficult was this writing activity? Please circle a number.

1	2	3	4	5	6	7	8	9
Very very easy		Easy		Medium		Difficult		Very very difficult

How much effort did you put into this writing activity? Please circle a number.

1	2	3	4	5	6	7	8	9
Very very little effort		Little effort		Medium effort		Much effort		Very very much effort



Lesson #3

Rebuttal

This lesson is going to teach you about how you can argue back against the other opinion and convince the readers of your opinion.

Here is what you can do to make a rebuttal great:

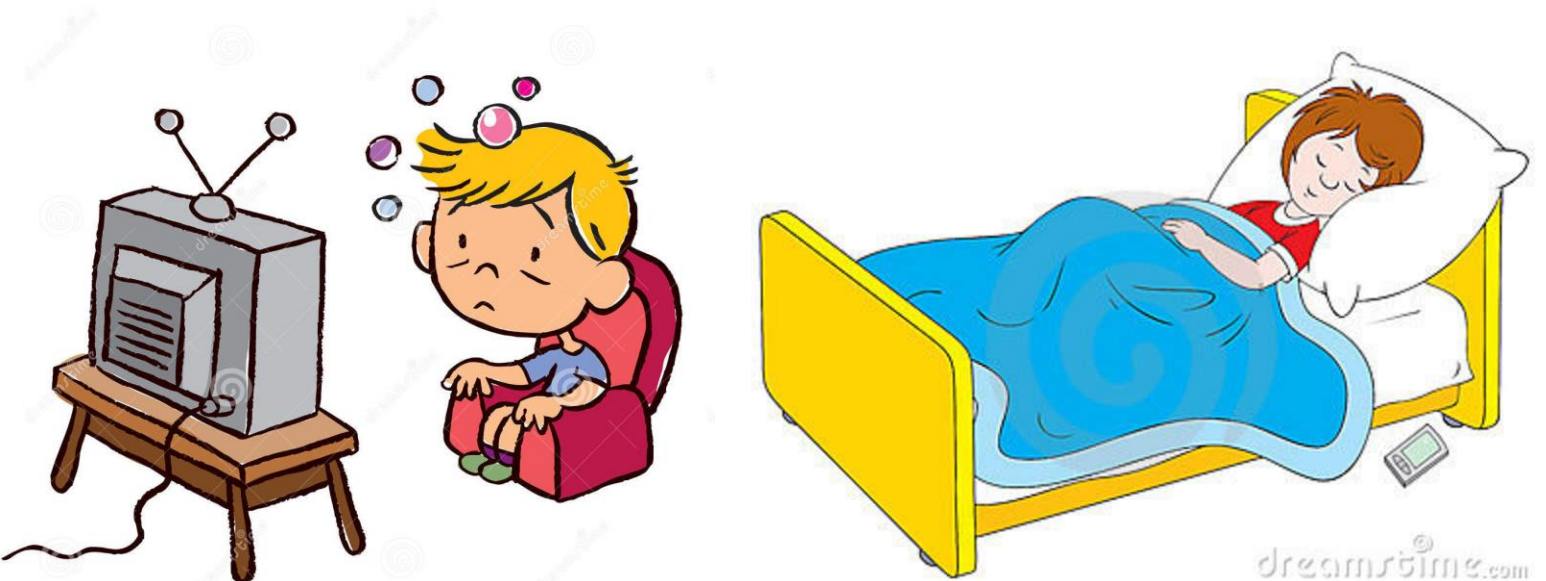
- Argue against the other opinion with another reason that supports your own opinion
- Show that though the other opinion may be true, your opinion is more correct

Example of how to argue back is highlighted:

I think that Halloween is the best holiday. Halloween is the best holiday because you get to dress up as anything that you want. Another reason that I love Halloween is because you get lots of candy and I love candy. Some people might say that Christmas is a better holiday because you get presents and do not have to worry about choosing a costume to wear. **Although this is true and presents are great, Halloween is a holiday where you can have more fun because you get to trick or treat.**

Do You Think That Children Should be Allowed to Choose Their Own Bed Time?

In my opinion, I do not think that children should be allowed to choose their own bedtime. If kids could choose their own bedtime then they would always be tired and never go to bed. They would get in trouble at school for falling asleep and would probably get a bad mark in their classes because they would always be too tired for activities. Also, sleep is important to keep you healthy so kids who always tried to stay up late and not get a good night's sleep may get sick too. Some people might think that kids should choose their own bedtime because they would say that it is your own body and only you know when you are tired.



Name: _____

Argument Writing Assignment #3

Checklist:

- Write your opinion
- At least three reasons to support opinion
- Other side of the argument
- Reasons for the other side of the argument
- Clear rebuttal

Imagine you are writing to your parents about getting money for your good grades on your report card. Do you think that parents should pay their children for getting good grades? Try to write one page of your opinion on this topic.

CoolClipArt.com



CoolClipArt.com
www.coolclipart.com

Handwriting practice lines consisting of 20 horizontal black lines spaced evenly down the page.

THE EFFECT OF SPEECH-TO-TEXT SOFTWARE ON LEARNING A NEW WRITING STRATEGY

Please answer the next two questions thinking about the text you just wrote.

How easy or difficult was this writing activity? Please circle a number.

1	2	3	4	5	6	7	8	9
Very very easy		Easy		Medium		Difficult		Very very difficult

How much effort did you put into this writing activity? Please circle a number.

1	2	3	4	5	6	7	8	9
Very very little effort		Little effort		Medium effort		Much effort		Very very much effort

Lesson #4

Conclusion

This lesson is going to teach you about adding a conclusion, which reminds the reader of your reasons and what you hope they will believe or do.

Here is what you can do to make a conclusion great:

- Remind the reader of your opinion
- Explain what you hope they will do or what they will think after reading your paper

Example of a conclusion is highlighted:

I think that Halloween is the best holiday. Halloween is the best holiday because you get to dress up as anything that you want. Some people might say that Christmas is a better holiday because you get presents and do not have to worry about choosing a costume to wear. Although this is true and presents are great, Halloween is a holiday where you can have more fun because you get to trick or treat. In conclusion, these are all the reasons why I think that Halloween is the best holiday. I hope that next time you think about your favourite holiday you will consider Halloween too!

Name: _____

Argument Writing Assignment #4

Checklist:

- Write your opinion
- At least three reasons to support opinion
- Other side of the argument
- Reasons for the other side of the argument
- Clear Rebuttal
- Conclusion

Imagine you could win a free airplane ticket to any place in the world. All you have to do is convince the airplane company of which city you thought was the best. Try to write at least one page about which city you think is the best in the world.



Please answer the next two questions thinking about the text you just wrote.

How easy or difficult was this writing activity? Please circle a number.

1	2	3	4	5	6	7	8	9
Very very easy		Easy		Medium		Difficult		Very very difficult

How much effort did you put into this writing activity? Please circle a number.

1	2	3	4	5	6	7	8	9
Very very little effort		Little effort		Medium effort		Much effort		Very very much effort

Appendix J

Cognitive Load Measure

Please answer the next two questions thinking about the text you just wrote.

How easy or difficult was this writing activity? Please circle a number.

1	2	3	4	5	6	7	8	9
Very very easy		Easy		Medium		Difficult		Very very difficult

How much effort did you put into this writing activity? Please circle a number.

1	2	3	4	5	6	7	8	9
Very very little effort		Little effort		Medium effort		Much effort		Very very much effort

Appendix K

Rating of Writing Mechanics and Persuasiveness

Surface Errors: Please identify the following surface errors and then record how many of them were present in each text. Please treat the error types as a hierarchy, that is, code ambiguous errors as being word errors first, or capitalization errors if that is not applicable, or punctuation errors if either of those were not applicable. Any one word can be categorized only as one type of error.

If there are multiple errors at the same point, please only code it as one error.

Example: **I think chose what they watch on TV.** There are multiple words missing between "think" and "chose" that is coded as one error and the word "chose" should be "choose" so that is an additional error because it is a new point in the sentence; therefore, that would be a total of 2 errors.

Type of Error	Definitions	Example and Count of Errors	Number of Errors
Word Error	<p>1. <u>Spelling Error</u> (a string of letters that is not a word)</p> <p>2. <u>Homophones</u> (words that sound the same, but are spelled differently, i.e., accept/except, no/know, through/threw)</p> <p>3. <u>Semantic errors</u> (meaning of the word is related to intended word, but not appropriate i.e., feet vs. shoe or me vs. I)</p> <p>4. <u>Missing words</u> (sentence is missing key words that would make it coherent)</p>	<p>1. He dose his homework at skool untill he finnishes it. = 4 errors</p> <p>2. The principle was two funny. = 2 errors</p> <p>3. It took I seven hours to write my math test. = 2 errors</p> <p>4. It fun if I school. = 1 error; if there is more than one missing word at a certain point, still code as 1 error.</p>	

	<p>5. <u>Pronoun error</u> (unclear pronoun reference)</p> <p>6. <u>Verb/subject disagreement</u> (verbs and subjects do not agree)</p> <p>7. <u>Apostrophe Use</u> (misuse of apostrophes in contraction words and possessive nouns)</p>	<p>5. The pencil broke, so I fixed them.</p> <p>= 1 error</p> <p>6. I like school because I can take books out of the library by himself.</p> <p>= 1 error</p> <p>7. I missed school today because my moms car wasnt starting.</p> <p>= 2 errors</p>	
<p>Capitalization Error</p>	<p>1. <u>Missing capitalization</u> (the first letter of the word following an appropriate end of sentence punctuation was not capitalized OR the first letter of a word of a new sentence OR a proper noun is missing capitalization OR first-person, "I," and its contractions [I'm, I've, I'll] were not capitalized)</p> <p>2. <u>Incorrect capitalization</u> (student capitalized the first letter of a word that was not a proper noun, was not first-person, "I," or its contractions, and was not following an end</p>	<p>1. i like school because the teachers are nice. they help me with my homework.</p> <p>= 2 missing capitalization errors</p> <p>2. Today at School I learned to Read.</p> <p>= 2 incorrect capitalization errors</p>	

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	of sentence punctuation)		
Punctuation Error	<p>1. <u>Missing punctuation</u> (appropriate punctuation mark was not placed). Do not also code missing capitalization if you were the one to insert the end of sentence punctuation.</p> <p>2. <u>Incorrect punctuation</u> (the appropriate punctuation mark was not used OR the student inserted a punctuation mark that does not suit the sentence)</p>	<p>1. I enjoy school because it will help me with my future another reason I like school is because it is fun = 2 missing punctuation errors</p> <p>2. During gym, we played indoor soccer and, hockey? = 3 incorrect punctuation errors</p>	
TOTAL			

Evaluation of Persuasive Elements

Please indicate whether the following persuasive elements are present within the text. Record the number of supporting reasons, explanation of reasons, and other persuasive elements in the text.

Persuasive Elements	Present (√)	Number	Definitions
Claim	<input type="checkbox"/>	_____	Writer's opinion used to persuade their reader: " I think school should sell candy. " In other words, the student's claim of what they think about the issue. Should be found in the beginning of the text.
Reasons	<input type="checkbox"/> <input type="checkbox"/>	_____	Evidence that the writer presents to support their claim(s): " The school could use money from candy to pay for field trips. " This is the other side or another perspective of the issue

Other Opinion		<hr/>	that someone else could have: " People might think candy is a bad idea. "
Reasons for the Other Opinion	<input type="checkbox"/>	<hr/>	Evidence that the writer presents to support the other side: " They might think this because it is not healthy "
Counter Argument	<input type="checkbox"/>	<hr/>	The writer's opportunity to argue back against the claims that they made for the other side: " That might be true, but I still think the school should sell candy "
Evidence to Support Counter Argument	<input type="checkbox"/>	<hr/>	Evidence the writer gives to support arguing back against the other opinion: " because kids bring lots of unhealthy food to school all the time, like chips. "
Ending/ Conclusion	<input type="checkbox"/>	<hr/>	The writer restates their opinion at the very end of their text. Example: " That is why I think that my school should sell candy. "
Total number of elements: <hr/>			

Example Texts for Coding

Do you think that kids should be able to choose which subjects they study in school?

In my opinion, I think that kids should choose the subjects that they study in school. First of all, if kids could choose what they wanted to study then they would be more interested in the topic and get better grades. My next reason is that kids would learn about things that are important to them and that would be more useful for them. My last reason is that everyone is good at different things and you should be allowed to practice what you are good at, at school instead of taking special classes for it, like music. Other people might think that kids should not choose their own subjects in school because then kids would not want to learn the hard subjects and that wouldn't help them in their future. That might be true but not everyone needs to learn every subject to help them in their future, if you know you will never use science then you shouldn't need to learn it. This is why I think that kids should be able to choose what subjects they study in school.

Do you think that children should choose their own bed time?

I think no. I think no because then they will stay up late and because they will fall asleep at school. Other kids would say yes. But I think no because kids are too young to choose this. That is why I think kids should not choose their own bed time.

Missing in this text:

Claim, 3rd supporting reason, Reason for other opinion

Appendix L

Teacher Letter of Information



Project Title: The Effect of Speech-to-Text Technology on Learning a New Writing Strategy

Principal Investigator: Katrina Haug, Faculty of Education, Western University

Teacher Letter of Information

1. Invitation to Participate

You are being invited to participate in this research study about the software program Dragon NaturallySpeaking, which is a speech-to-text program and its usefulness in learning persuasive writing. Persuasive writing is based on the Ontario elementary writing curriculum for Grade 5 and will be important in the Grade 6 EQAO assessment. As the classroom teacher, your participation includes providing instruction for both Dragon NaturallySpeaking and persuasive writing using materials and lesson plans that will be provided by the researcher. All of the students in your class will receive instruction but those who consent will allow the researcher to use their writing activities as data for the study.

2. Purpose of the Letter

The purpose of this letter is to provide you with information required for you to make an informed decision about whether you may want to participate in this research.

3. Purpose of this Study

The purpose of this study is to learn about how using a software program such as Dragon NaturallySpeaking, may affect student learning in of a writing genre, in this case persuasive writing.

4. Inclusion Criteria

All students in the Thames Valley District School Board or London District Catholic School Board, in a Grade 5 class are eligible to participate in this study.

5. Exclusion Criteria

No students will be excluded from this study.

6. Study Procedures

If you agree that you would like to participate, then you will be provided a series of lesson plans, materials and activities for teaching both Dragon NaturallySpeaking and persuasive writing. Using these materials, you will provide instruction to the students in your class on both persuasive writing and Dragon NaturallySpeaking. All students receive the same instruction in both Dragon NaturallySpeaking and persuasive writing. Students will use the software Dragon NaturallySpeaking or traditional pencil and paper method to complete writing activities. Students will be randomly assigned to the handwriting group or the Dragon NaturallySpeaking group.

Persuasive writing is broken into 4 lessons each focusing on a different component of writing. Each of these four lessons requires approximately 30 minutes. In addition, Dragon NaturallySpeaking requires four lessons, the initial will take approximately 30-40 minutes and the following are small activities that should take about 15 minutes. The tasks will be conducted in the students' regular classroom or in the computer lab for access to the software. The study will include about 25 students in this school, and about 50 students in total. The study will take place at a time of your choosing, when it is appropriate for the class to begin a unit on persuasive writing.

If you choose to participate, you will be asked to follow the lesson plans and use the materials provided this is to ensure that all the participants receive the same instruction even if they are at a different school. To measure this, the research (Katrina Haug) will observe the lesson.

All students in the classroom will participate and learn even if they do not consent to the research.

7. Possible Risks and Harms

There are no known or anticipated risks or discomforts associated with participating in this study. The students' grade on the quiz will not affect his or her report card grade.

8. Possible Benefits

The possible benefit to society may be the knowledge of effective interventions in aiding students with the writing process especially for genres that are typically difficult.

9. Compensation

You will not be compensated for participation in this research.

10. Voluntary Participation

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time.

11. Confidentiality

All writing samples that are collected will remain confidential and accessible only to the investigator of this study. While we will do our best to protect information there is no guarantee that we will be able to do so. The data from our study will be stored in an electronic database, but no personal information, such as your name, initials or birth date, will be included. If you choose to withdraw from this study, your data will be removed from our database and destroyed. If the results are published, your name and the name of the school will not be used.

Representatives of The University of Western Ontario Non-Medical Research Ethics Board may contact you or require access to you to monitor the conduct of the research.

12. Contacts for Further Information

If you require any further information regarding this research project or your participation in the study you may contact

If you have any questions about your rights as a research participant or the conduct of this study, you may contact The Office of Research Ethics

13. Publication

If the results of the study are published, neither your name nor the name of the school you teach at will be used. If you would like to receive a copy of any potential study results, please contact Katrina Haug.

14. Consent

You may participate in the study if you sign the attached consent form.

This letter is yours to keep for future reference.

Consent Form

Project Title: The Effect of Speech-to-Text Technology on Learning a New Writing Strategy

Study Investigator's Name: Katrina Haug

I have read the Letter of Information, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Classroom Teacher Print: _____

Classroom Teacher Sign: _____

Classroom Teacher Date: _____

Person Obtaining Informed Consent (please print): _____

Signature: _____

Date: _____

Appendix M

Holistic Text Quality Rater Guide

Please rate the overall quality of texts as a pieces of persuasive writing by following these steps:

1. **Rater 1:** Browse through the texts.
2. **Rater 1:** Read the texts again, and choose seven papers to represent each point of a 7-point rating scale ranging from (1) very low quality to (7) very high quality , with (4) being average quality. Base your selection on ideas, content, organization and overall persuasiveness. Please ignore surface errors.
3. Once **Rater 1** has successfully chosen the seven anchor papers, both raters will then sort all of the compositions into seven piles using the anchor papers as indexes of the reflective pile.
4. Read through each pile again to verify that all the texts are similar to their chosen anchor/index text.
4. On a separate piece of paper, please make a list of ratings by indicating the following:
 - a) the ID number found in the top left-hand corner (i.e., "410R");
 - b) text quality rating

Katrina Haug

Qualifications Profile

- Master's thesis research regarding speech-to-text technology's influence on learning a new writing strategy
- Undergraduate thesis research in psychology at the University of Windsor
- Two years experience as a research assistant working on several different research projects at the University of Western
- Excellent written and oral communication skills
- Adaptable and organized, takes pride in working hard
- Extensive experience working with children of different ages, backgrounds and abilities through both volunteer work as well as employment

Education

PhD in School and Applied Child Psychology 2020
University of Western Ontario - London, Ontario

- Currently in the first year of the PhD program

Master of Arts in Education, Psychology and Special Education 2016
University of Western Ontario - London, Ontario

- My thesis investigated speech-to-text technology (Dragon NaturallySpeaking) and its effects on student learning of persuasive writing as well as cognitive load. It was a pretest-post-test between groups design using grade 5 students (N = 43). Variables measured included: word errors, surface errors, holistic quality, rhetorical moves, word count and cognitive load.
- Research assistant work has involved persuasive writing, writing to learn and working memory. As a research assistant responsibilities included travelling to schools in the

Thames Valley District School Board to conduct research projects in different classrooms as well as coding and organizing data.

Bachelor of Arts in Honours Psychology and Sociology Minor 2013
University of Windsor - Windsor, Ontario

- Completed the Honours psychology program at the University of Windsor with a thesis. Thesis work investigated undergraduate students' sense of entitlement in terms of grades and success at the university level. Worked with graduate students to help develop entitlement scales to be used as measurement tools at the university level. Completed a poster presentation of this thesis project at the University of Windsor.

High School Diploma: 2008
St. Anne's Catholic High School

Publications and Conference Presentations

Klein, P. D., Haug, K. N. & Arcon, N. (Accepted pending revisions). The effects of rhetorical and content subgoals on text, cognitive load and learning. *Journal of Experimental Education*.

Klein, P. D., Haug, K. N. & Arcon, N. (2015, August). *Argument writing as discovery: Effects on cognitive load, reasoning, and learning in science*. Paper presented at the Argument-Based Inquiry Conference. Spokane, Washington.

Klein, P. D., Dadd, L. M., & Haug, K. N. (2014, February). *The effects of rhetorical and content subgoals on text, cognitive load and learning about classification*. Paper presented at the Writing Research Across Border Conference of the International Society for the Advancement of Writing Research, Paris, France.

Haug, K. N. & Klein, P. D. (Applied, pending review). *The effect of speech-to-text software on learning a new writing strategy*. Applied to present at SIG International Conference on Writing Research in July 2016, Liverpool, UK.

Professional Experience

PALS Math Tutor

Windsor Essex Catholic District School Board

10/2015 to Present

Responsible for grade 4 and 5 students after school to supervise and facilitate the PALS math program to further their understanding and knowledge of mathematics (addition, subtraction, division and multiplication).

Waitress

Frank Brewing Company - Tecumseh, Ontario

11/2015 to Present

Responsible for ensuring customers have an enjoyable experience through talking to customers about the process of making our beer and styles of beer as well as menu options, taking their order, operating the cash register as well as keeping the restaurant and bar clean.

Waitress

Vangs Thai Restaurant - Tecumseh, Ontario

09/2015 to 12/2015

Responsible for ensuring customers have an enjoyable experience through talking to customers, taking their order, using the cash register and taking takeout orders over the phone. As well as keeping the front of the restaurant clean.

Research Assistant

University of Western Ontario - London, Ontario

09/2013 to 07/31/2015

Organized and administered research projects in various classrooms in the Thames Valley District School Board. Evaluated and coded students written work to be used as data for various research projects.

Nanny

Ducharme Household - London, Ontario

09/2014 to 12/2014

Responsible for the care of children ages 9 -13, driving to and from after school commitments as well as cooking, cleaning and homework assistance in both English and French.

Assistant English Teacher

GPI North America - Windsor, Ontario

07/2012 to 08/2014

Assistant English teacher for Japanese exchange students aged 15 - 16 while they are participating in a Homestay program during the summer months. Responsibilities include: organizing and supervising activities, communicating with host families, and assisting to teach the English lessons in the classroom.

Nanny

Oldridge Household - Tecumseh, Ontario

06/2008 to 06/2013

Cared for two boys from the age of 2 - 5. Preparation of meals, light housework, helping with schoolwork.

Volunteer Work

2010 - 2015	Volunteer with W.R.A.C.E Windsor, Ontario
2012 - 2013	Drop-In Program volunteer with St. Mary's Family Learning Centre Windsor, Ontario
2012 - 2013	Volunteer with the Windsor-Essex Therapeutic Riding Association Windsor, Ontario
2012 - 2013	Volunteer at the Summit Centre for Children with Autism Windsor, Ontario

