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The Impact of Computer-Generated Feedback on Student Perceptions of Revision Process

An Action Research Report

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The Impact of Computer-Generated Feedback on Student Perceptions of Revision Process

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Abstract

The purpose of this research was to determine how computer-generated feedback impacts students' perceptions of feedback and revision in comparison with previous teacher-provided feedback. The study, conducted with 41 juniors in two suburban high school English III classrooms, spanned eight weeks. The data collected included student perceptions of feedback pre- and post-intervention and computer-generated percentile rankings of students' writing skills. Findings indicated that computer-generated feedback increased students' writing efficacy and inclination to revise. Further research regarding the impact of continued implementation and application of computer-generated feedback on students' writing skills would be beneficial.

*Keywords*: perceptions, computer-generated feedback, writing, revision
Education is a continually evolving field of study and practice. Changes to the learning standards exemplify one factor in this constant revision. According to the Common Core State Standard’s “Introduction to the 6-12 Grade Writing Standards,” students must be able to exhibit “increasing sophistication in all aspects...and they should address increasingly demanding content and sources” (“English Language Standards, n.d.). Sundeen (2015) states that these changes to the Common Core stress the heightened importance of engaging students in more and diverse writing tasks.

Changes to the way teachers teach represent another evolving factor, with technology integration being one of the most dynamic developments. Hamilton, Rosenberg, and Akcaoglu (2016) state that while technological trends and utilizations cannot be predicted, the International Society for Technology in Education (ISTE) (2015) has developed guidelines to support this integration of technology and outline digital-age skills. Additionally, Puentedura’s (2006) Substitution, Augmentation, Modification, and Redefinition (SAMR) model describes how different technological implementations can cognitively vary and encourages teachers to develop their integration of technology. In the English classroom, the challenges of developing increasingly sophisticated writers and enriching the utilization of technology can either correlate or contradict each other.

From typewriters to word processing applications, technology has been a part of the writing process for decades. With the addition of computers, newer forms of technology consistently contribute to the substitution and augmentation of the writing process. Puentedura (2014) identifies substitution as the lowest level of the SAMR model, which implements technology as a direct replacement for analog activities but does not alter the intended product: students writing an essay on paper adapts to students typing an essay. These word processors
also augment the revision and editing process, still directly replacing longhand writing, but additionally improving the writing process with automated grammar and spell check features. When students share their writing digitally, the collaborative, peer-review capabilities modify the revision and review process. Incorporating online sharing and comments significantly redesigns how students can give and receive feedback. However, even with implementing word processing and digital sharing, the writing process still faces some potential obstacles.

Technology changes many aspects of the writing process, but the teacher's part in the process has remained much the same, including assigning the prompt, providing structured support as needed, and providing feedback either during or following completion of the writing depending on the timeline of the assignment or complexity of the assigned task. Baker (2014) points out an obvious handicap teachers face in trying to provide meaningful feedback and writing instruction: thorough evaluation and feedback require extensive amounts of time. The more students a teacher has in their classroom, the more burdensome the task of providing quality feedback. The intent of integrating technology via computer-generated feedback tools could redefine the revision process. If implemented, computer-generated feedback would simultaneously provide accurate and constructive feedback and alleviate pressure placed on the teacher to offer timely and informative feedback that, due to time constraints, is infrequently implemented (Sundeen, 2015).

This action research project endeavors to answer the central question of how computer-generated feedback impacts students' perceptions of feedback. Designed to examine student perceptions and willingness to revise their writing before and after implementing a computer-generated feedback tool, the project analyzed the perceptions of English III (eleventh grade) students. Students from two English III sections, all individuals enrolled in the course for the
first time, were the focus of the study. Two sections were chosen since one has a more traditional class size of 25 students and the other has 18 students on the roster. These class sizes, while separated by only seven students, still embody the significant variance class sizes play in the demands on a teacher, both in and outside of the classroom. The results of this study can inform any teacher looking to incorporate more structured or formal writing into their curriculum about the potential value of computer-generated feedback.

**Review of Literature**

Writing tasks are varied in both complexity and purpose, with many elements that encompass the writing process (Roscoe & McNamara, 2013). Providing feedback is one method teachers employ to help their students develop as writers (Debuse, Lawley, & Shibl, 2007). Both Higgins, Hartley, and Skelton (2002) and Thurmond, Wambach, Connors, and Frey (2002) noted that students need progress and performance feedback to engage and reflect on their writing skills (as cited in Debuse et al., 2007). The following literature outlines the current roles and methods of providing feedback in the English Language Arts (ELA) classroom and describes potential impacts automated-feedback generators might have on student perceptions and products of writing.

**Definitions and Methods of Feedback in the Classroom**

A variety of factors are involved in the feedback process. One definition of feedback refers to feedback as the data provided to someone about their efforts and the pursuit of a goal (Wiggins, 2012). Feedback is also defined as audience-provided input that leads to the writer revising a composition (Calvo & Ellis, 2010). Feedback has the potential to guide and improve learning (Parkin, Hepplestone, Holden, Irwin, & Thorpe, 2012). Felix (2001) identified feedback as beneficial for students of all ages (as cited in Debuse et. al, 2007). James, McInnis, and
Devlin (2002) and Wiggins (1997), describe effective feedback as timely (immediacy), informative, and detailed (as cited in Debuse et al., 2007). Effective feedback could be provided multiple ways, from quick verbal feedback in a classroom situation to formal, embedded assessments such as end-of-unit tests (Ruiz-Primo & Li, 2013).

Just as many elements comprise feedback, feedback could also be provided in multiple ways (Govindasamy, Hoon, & Fung, 2013). According to Cole (2009), feedback might take the form of verbal or written comments with the goal of determining students’ progress towards achieved a writing goal. Cole (2009) further defines feedback as “any response that helps the writer write more, write better, and be a happier person” (p. 13).

Teachers deliver feedback via numerous methods: written, verbal, teacher, classmate, small group, or computer-delivered (Govindasamy et al., 2013). Written feedback fluctuates in depth and specificity. Teachers in Ruiz-Primo and Li’s (2013) study of interactive notebooks and periodic writing logs found that feedback varied from being specific but focused on specific writing skills to being minimal, with few suggestions for student improvement. Overall, written comments had the potential to lead to deeper discussions with students about their writing and learning (Ruiz-Primo & Li, 2013). Hope (2011) and Ice, Curtis, Phillips, and Wells (2007) both found that students pay more attention to audio feedback because students can review comments with ease and understand the comments better (as cited in Wolff-Hilliard & Baethe, 2014). The researchers used built-in microphones and headsets to provide oral feedback and students enjoyed the conversational aspect of the guiding comments (Wolff-Hilliard & Baethe, 2014). Early and Saidy (2014) implemented a feedback intervention, which included peer feedback and self-led feedback (the writer her/himself used a series of reflective prompts or categories to give themselves feedback). Afterward, the researchers examined and coded all of the students’
revisions and analyzed the feedback students received from peers after a three-day workshop. They found that peer feedback and self-led feedback helped students more deeply examine and recognize where and how to revise their work (Early & Saidy, 2014).

**Shortcomings of the Current Feedback Process**

Writing is a time-intensive process for both students and educators, which is especially challenging for teachers on an already tight schedule to provide specific and immediate feedback (Wolff-Hilliard & Baethe, 2014). Haswell (2006) noted that the necessity of providing timely, appropriate feedback pressures some educators to find shortcuts or technological tools to ease these workload challenges. Haswell (2006) further remarked that with the complexities of writing, attempts to simplify the grading task either overlooked the intricacies or created a larger and more cumbersome assessment task. With student essays needing both assessment and feedback, some instructors would share verbal feedback of a small sample of student papers to the entire class, with the assumption that students would recognize areas for improvement in their writing (El Ebyary & Windeatt, 2010). This method of feedback implementation had adverse effects; in one study, students reported copying from each other, guessing that the course instructor might not look at their draft, if at all (El Ebyary & Windeatt, 2010).

McGarrell and Verbeem (2007) and Shute (2008), emphasized the importance of individualized and formative feedback with clear suggestions for revisions such as developing a thesis and further analyzing evidence (as cited in Roscoe & McNamara, 2013). However, researchers found that the lack of time and increasing class sizes hinder teachers’ abilities to provide timely, specific feedback (Toranj & Ansari, 2012). Lee (2011) analyzed teacher’s written feedback processes through coding and reflection of provided feedback and found that the majority of written feedback focused on errors, rather than the structure or content of the
writing. Much of written feedback focused on form, telling students what mistakes they had made (Lee, 2011). After coding and analyzing teacher feedback on student essays, Lee (2011) reported that much of writing feedback consists of markings on text, with 94.1% of the feedback focused on form, only 2% of that accompanied or comprised teacher comments.

According to Beach and Frederich (2006), secondary students, regardless of writing ability, did not always have chances to revise their writing (as cited in Early & Saidy, 2014). Educators expressed doubts about the “efficacy and cost-effectiveness” of their feedback, questioning whether their efforts will lead to the development of students’ writing skills (Lee, 2011, p.379). In response to the pressure of providing timely feedback that often overwhelms writing teachers, Lo & Hyland (2007) found that teachers assess writing more often than they make it an instructional focus.

**Defining Automated Feedback Generators and Automated Essay Scoring**

Automated feedback could provide multiple benefits. Shermis and Burstein (2003) point out that automated essay scoring instantaneously scores and evaluates writing products. Computer-based tools scored writing objectively and reliably, employing the same criteria to evaluate many compositions consistently and concurrently (Roscoe & McNamara, 2013). Researchers and computer scientists have developed tools and evaluative systems to analyze and provide explicit guidance for student writing (Gerard, Ryoo, McElhaney, Liu, Rafferty, & Linn, 2016). Hyland and Hyland (2006) also reported that these sophisticated systems were thought to be an effective cost- and time-saving method to complement direct human input. For teachers, automated grading presented the possibility of reprieve from hours of written comments, but students would still receive comprehensive feedback in a compressed time frame (Hyland & Hyland, 2006).
Different automated systems offer different features, focusing on various methods for evaluating writing and providing feedback and developed primarily for native English-speakers (Dikli, 2010). *Glosser* evaluated structure and keywords but did not focus on surface-level errors such as spelling and grammar (Calvo & Ellis, 2010). With their participants interviewed individually, Calvo and Ellis (2010) learned students perceived *Glosser* to be useful for finding surface errors for the express purpose of getting higher marks. Reiners, Dreher, and Dreher (2011) examined the value of the *Turnitin* service (now being re-branded as *Revision Assistant*), using surveys to find the main draw of this site (and automated assessments in general). Their findings determined the main benefits as plagiarism detection and that the majority of their respondents leaned towards using automated assessments for multiple choice questions and plagiarism checks (Reiners et al., 2011). Chapelle, Cotos, and Lee (2015) evaluated two systems, *Criterion* and *Intelligent Academic Discourse Evaluator (IADE)*, by observing the implementation process and accessing and comparing students’ writing and feedback with the original and revised drafts. They found, through the use of coding schemes, color-coded feedback, and semi-structured interviews that *Criterion* offered accurate feedback and *IADE* led students to internalize the importance of intended versus expressed meaning (Chapelle et. al, 2015).

**Reasons Why Automated Feedback Is Not Currently Implemented**

However, many teachers have never implemented automated feedback generators or scoring systems (Reiners et al., 2011). Reiners et al. (2011) found that despite the availability of these automated assessment approaches, 60 of 256 participants, a combination of students and instructors, had never implemented automated assessments. The major roadblocks that stopped educators were a lack of awareness of current automated assessment software and a reluctance to
use new technology (Reiners et al., 2011). The use of computer-generated scoring and performance feedback is still a comparably new topic of research in instructional contexts, although Chapelle and Cho (2010) stressed the value in education and commercial spheres (as cited in Xi, 2010).

Another part of the reluctance to implement automated-feedback generators stemmed from the belief that humans could assess writing more discerningly than computers (Reiners et al., 2011). Weigle (2010) suggested that development of automated scoring and feedback systems was not refined enough to score writing elements such as organization, content, and meaning (as cited in Xi, 2010). While teachers might not want to replace human-provided feedback in a summative sense, both Dikli (2006) and Warschauer and Ware (2006) pointed out that computer-generated scoring and feedback systems could bolster discussion of writing skills and engagement in assessing writing drafts in the classroom environment (as cited in Dikli, 2010).

**Potential Impacts of Automated Feedback on Student Perceptions**

As Warschauer (2002) shared, technology was not merely a method for students to receive feedback, but, more importantly, a resource capable of a variety of approaches to improving writing (as cited in Toranj & Ansari, 2012). Most feedback practices were teacher-oriented, with the bulk of the actions centered on teacher’s actions rather than learner reactions (El Ebyary & Windeatt, 2010). When teachers gave feedback, they were also teaching students how to teach themselves, to in turn provide feedback (Johnston, 2012).

With the automation of assessment, students had more opportunity to monitor their learning and to make decisions based on self-assessment and nearly immediate, objective feedback (Wolff-Hilliard & Baethe, 2014; Spector et al., 2016). Even if automated feedback was
used merely for error location, students then had to determine for themselves strategies to independently edit and revise their papers; when teachers located all the errors, students did not have the opportunity to internalize these strategies (Lee, 2011).

Writers required feedback to develop their writing skills, with feedback being a critical feature of feedback, necessary at every stage of the writing process (Govindasamy et al., 2013). While meaning was not relevant to students at the beginning of the IADE process, they had begun to recognize and look for verification of their organization and word choice (Chapelle et al., 2015). Access to automated feedback increased the likelihood students would view and implement the suggested feedback (Parkin et al., 2012). Some computerized feedback and assessment systems allowed teachers to provide traditional, narrative feedback from a pre-written comment bank, which reduced the time spent providing analytic and holistic feedback (Wolff-Hilliard & Baethe, 2014).

Reiners et. al (2011) found that 56.6% of those surveyed ranked automated assessment as either somewhat or very useful when compared to normal, or human, assessment. Students placed value on the flexibility offered by automated feedback, which provided choices in time and location for students to access suggestions (Parkin et al., 2012). Student responses from Calvo and Ellis’ (2010) study showed students’ growing positivity in viewing automated feedback as a way to improve understanding of an assigned topic and gaining different perspectives and understanding of one’s writing skills. Calvo and Ellis (2010) also suggested that more direct explanation of feedback’s purpose would only increase students’ understanding and perceived value of automated feedback. Similarly, students’ perceptions of feedback generated by the automated feedback generator (AFG) system, which provided feedback at the click of a
button, were that students appeared to find this feedback constructive and comparable to feedback manually delivered (Debuse et al., 2007).

Conclusion

Hattie’s (2009; 2012) research rated formative assessment as one of the most effective approaches to support student achievement (as cited in Spector et al., 2016). In the same manner, the more promptly educators provided feedback, the more useful that feedback was (Johnston, 2012). Years of research, including Bransford, Brown, and Cocking (2000), Hattie (2008), as well as Marzano, Pickering, and Pollock (2001), also supported the idea that when educators provided more feedback, greater learning occurs (as cited in Wiggins, 2012). Both Roscoe and McNamaara (2013) and Dikli (2006; as cited in Chapelle et. al, 2015) maintained that most of the research regarding automated assessment systems fixated on scoring accuracy. However, as an alternative, or even a guide for assessment, other experiments showed automated essay grading could be as accurate as human scorers, on specific tasks (Reiners et. al, 2011). Criterion succeeded in improving student work, mostly for mechanical properties (Roscoe & McNamaara, 2013). Warschauer and Ware (2006), Attali and Burnstein (2006), Dikli (2006), and Rudner et al. (2006) are among the researchers who had found positive connections between computer-generated and human scores: a .80-.85 correlation between computer-generated scores and human scorers, as well as 90-100% adjacent relationship within a point of each other for these two scoring methods (as cited in Roscoe & McNamaara, 2013).

Hedgcock and Lefkowitz (1994, 1996), Leki (1991), Olajedo (1993), and Saito (1994) all stated that teachers, particularly teachers that explicitly taught writing, would spend considerable time providing feedback for their students' writing, and that students valued this feedback (as cited in Lee, 2011). Because feedback is vital and ever-changing, it is a critical strategy that
should be visible at every stage of the writing process, to help students develop their writing skills (Govindasamy et al., 2013). Formative assessment has gained significance and grown easier with new technologies (Spector et al., 2016). As learning continues to incorporate technology, timeliness will continue to be counted as a critical factor, one difficult for teachers to achieve without implementing technology-enhanced feedback systems to some degree (Spector et al., 2016). The use of formative feedback has been found to be directly proportional to motivation and increased proficiency, and computer-generated feedback would help improve student perceptions of feedback and motivations to revise (Spector et al., 2016). Many respondents saw advantages in automated assessment and feedback over or in combination with human scorers (Spector et al., 2016; Reiners et al., 2011). The advancement of and opportunities presented by technology and the indicated efficacy of computer-generated feedback makes an impressive case for educators to consider implementing it as a method to develop student writing in an adept manner.

**Research Methodology**

The study was conducted over a period of nine weeks, starting in mid-January and going into March. The 41 English III student who participated in the study were enrolled in the course for the first time, and their participation in the study was voluntary. Students and parents had the opportunity to opt out (Appendices A, B, and C). Four different data tools were used to collect information on students' perceptions of computer-generated feedback and on the impact computer-generated feedback had on their writing. Questionnaires were used to gather student perceptions, while data reports and teacher-created revision-focused rubrics measured the impact computer-generated feedback had on students' writing.
As an introduction to the study, a baseline questionnaire was distributed via a GoogleForm to students (Appendix D). Qualitative and quantitative questions were used to ascertain students' previous experiences with feedback. Overall, the questionnaire sought to determine what students could recall about the feedback they've received, specifically regarding time spent providing or applying feedback, timeliness of the feedback itself, perceived value of the feedback students received and the students' likelihood of revising their writing following feedback. Purposefully general, the questions ensured that students were not focused on any one teacher or feedback experience, but on writing feedback, regardless of content area.

Since the focus of this research was on student implementation of computer-generated feedback, students were first assigned the initial argumentative, or persuasive, writing prompt to develop a draft that they would receive feedback on. All students participating in the study were assigned the same grade-level prompts. All students were assigned a standard, grade-level, teacher-chosen topic for each prompt. The single topic ensured the consistency of students’ writing focus and the automated feedback response. For the first two prompts, students received the prompt a day in advance of the drafting day, to provide time for questions regarding the topic or the structure or other questions students might develop. For the third and fourth prompts, students received the prompt at the beginning of class and spent the rest of that same day composing a rough draft. Applied to more closely reflect the conditions of the ACT (American College Testing) writing exam, these changes prepared students for the testing environment they would soon face. Students then received a day to engage and apply their automated feedback. Overall, the research spanned the introduction, drafting, revision, and polishing of four writing prompts.
While a variety of tools, including *Grammarly* and *Revision Assistant*, could have been implemented, *PaperRater* was selected as the tool for students to apply. The primary drawback of *Grammarly* was that a premium account is required for access to feedback on “Advanced Issues.” *Revision Assistant* would be a valuable tool for classroom use, but at the time, the district did not purchase this tool for student or teacher use. Although *Grammarly* does offer some feedback for free through its extension for the *Chrome* browser, *Grammarly* proved the weakest choice of the three tools, limited in instructional opportunity and quantifiability. From a teacher’s instructional standpoint, *Grammarly* offers specific changes that would be beneficial for students. However, unless students clicked on the drop-down menu for each change, they would not understand why these changes should be made. This tool would help students immediately improve their writing, but would not aid in students' retention of these writing fixes. Also, measuring students' improvements while using *Grammarly* would be difficult to measure.

Comparatively, *PaperRater* provided students with more extensive feedback than *Grammarly* and teachers with easily quantified data, for no cost. *Revision Assistant*, while easily quantifiable, required a fee to access the tool and was geared towards primarily ELA courses, which would initially limit the application of the tool across curricula. The lack of a fee or log in made *PaperRater* user-friendly and versatile, potentially used for either ELA or non-ELA courses. Feedback provided covered the broad categories of spelling, grammar, word choice, and style, with the latter two having several sub-categories as well. Student revisions were also easier to measure; for every draft that students submitted to the provided teacher code, the students’ skills scores were also recorded.

For the first two prompts, one week after students were provided time to outline and compose a rough draft of their argument, students went back to their initial drafts and spent the
class period reviewing and applying the computer-generated feedback from PaperRater to their writing. Although students were not required to treat these prompts as typical writing assignments by working on the drafts as homework, a portion of students did. Students that worked on the prompts outside of class were not offered any benefits or bonuses for these efforts since one period of class time was dedicated to allowing students to analyze and implement revisions based on the computer-generated feedback they received. For Prompt One, students were provided with a checklist of the suggested elements to include in their persuasive essay: a claim, a counter-argument paragraph, at least two paragraphs supporting the claim with evidence and explanation, and a conclusion. For Prompts Two and Three, students were provided with an advanced organizer for pre-writing and organizing their argument (Appendix E). The organizer was provided as scaffolding for students struggling with structuring their persuasive arguments. For Prompt Four, students were verbally reminded of these elements but received no visual guide, either projected or hard copy. The scaffolded organizers were removed to mimic the standardized testing procedures that students would soon encounter with the ACT, which all eleventh-grade students in the school took at the end of March. Also, similar to other writing purposes students had already mastered, organizers were also removed to increase student writing independence.

At the beginning of the revision class period, a category of feedback was suggested, to provide students a starting point in reviewing their feedback. For the first prompt, teacher input was limited to suggested categories for students to focus on, categories where small changes could garner large gains. An example of the discussion would be “It looks like this example makes pretty good use of transitions, but has a very low score for sentence beginnings. What could the writer do to improve this?” For example, a student might be asked “What category are
you focusing on?” or “Is there any feedback that you are having difficulty understanding?”

Follow-up questions or clarifications would be along the lines of “Well, for word choice, what they are looking for is strong words; if you look here, the feedback says you use words like ‘a lot, nice, stuff, good, very.’ You’ll want to fix those.” For example, a writing sample of the instructor's was projected, and specific categories were suggested: “I would look at my scores for each of these categories [spelling, grammar, word choice, and style] to determine which I struggle with most. The ones that I am struggling with most, I would focus on today.”

For the second prompt, teacher suggestions were repeated and shown with a projected example prompt and quick review of what feedback the prompt received. These questions and clarifications did not present teacher-provided feedback, but instead guided students in breaking down and understanding the computer-generated feedback. Following Calvo and Ellis’ (2010) study, students needed specific instruction on how to engage with the automated feedback. The third and fourth prompts’ revision days followed the layout of Prompt Two in delivery and but not teacher clarification. A brief review of the feedback categories was provided, and a general checklist would be projected for the remainder of the class period (Appendix F). One-on-one conferences were limited to students who either did not appear to be working or sought out teacher clarification or guidance. During prompt one’s revision time, there were three to four students, less than 25% of the class, that sought help; for the remainder of the revision cycles, little to no teacher guidance was needed.

Throughout the writing process, students were required to submit their writing a minimum of two times to the assigned dropbox using the provided handout and teacher code (Appendix G). These submissions were used to create the baseline and final data points of PaperRater’s scores for students’ writing in the categories previously outlined.
PaperRater provides feedback in the categories of spelling, grammar, word choice, and style, the tool also quantified these skills by percentile ranks if the writer selects the grade level. When the students enter the teacher code, the teacher received the draft and an account of the writers’ skills. When creating the dropbox for each prompt, the teacher also received a link to a compilation of all student submissions and percentiles (Appendix H). Before revision day, this link was accessed to determine which categories to suggest to the entire class or for particular students. From student submissions, which PaperRater forwarded to the teacher-designated email address, and the comprehensive report, which PaperRater also collected, students’ implementation of computer-generated feedback was determined. Student submissions were examined to determine how students applied the computer-generated feedback. The comprehensive report, pulled after students’ final submissions, included both students initial drafts and final, revised drafts; this report numerically showed student growth and application of computer-generated feedback.

While students were left mainly to their own devices to apply the feedback for their first writing process, the strategies and teacher-guided discussion of computer-generated feedback previously described were integrated into the revision day process for the subsequent revision days. The intention of guiding students to grapple with the computer-generated feedback with minimal teacher guidance by themselves was multifaceted. First, minimum teacher-guidance would replicate the process of students receiving and applying computer-generated feedback outside of the classroom; relying on the teacher would have clouded student perceptions of the PaperRater feedback. Intensive teacher-guidance would also have negated one goal of computer-generated feedback: to create self-guided learning. The focus on computer-generated feedback
was continued with all of the prompts. After each writing prompt, the Paper-Rater compiled report was downloaded and writing skills baselines and improvements were analyzed.

Additionally, after each writing prompt, students’ final drafts were assessed using the Revision Rubric (Appendix I). This rubric was developed to holistically analyze the depth of student revisions and overall improvement from the initial rough draft to the final draft. These learning objectives were added to the department-wide argumentative writing rubric. As the focus of the research was limited to students’ perceptions of feedback, these specific revision-centered objectives were analyzed to quantify how, and to what degree, students implemented the computer-generated feedback they received. This method of assessment allowed for both students who made numerous, superficial revisions, and students who made few, but intensive, revisions; for example, students who made superficial grammatical or punctuation changes and students who made intensive active voice, sentence variety changes would both earn revision points. With the goal of engaging with and applying feedback, the different categories of revision were all assessed similarly, rather than being weighted.

Following the completion of the drafting and revisions of the second and fourth writing prompts, students were given a chance to reflect on their writing and revision processes. Students were also asked to reflect on their perceptions of the role and value they felt PaperRater had on their writing, using the Mid-Intervention and Post-Intervention questionnaires via Google forms (Appendices J and K). The purpose of the mid-intervention questionnaire was to determine if students were experiencing any difficulties with their computer-generated feedback that could be addressed and could affect their perceptions of PaperRater. Because of the responses to the mid-point questionnaire, the organizers and checklists were first implemented and then continued. Some of the student feedback from the mid-point questionnaire suggested students were having
difficulty with developing a structured response; the organizers and checklists allowed students guided support in developing their arguments, to ensure students had writing to apply feedback to. Both the mid-point and post-intervention questionnaires repeated the qualitative and quantitative questions initially used in the baseline questionnaire to determine what students perceived as valuable from their experience with PaperRater computer-generated feedback. Overall, the two questionnaires sought to gather information regarding students’ perceptions of the quality of the computer-generated feedback and the perceived benefits and drawbacks of this PaperRater feedback.

**Analysis of Data**

The data collected for this study focused on student perceptions and student implementation of feedback. To gather information on both, a variety of methods were engaged, beginning with a questionnaire distributed to the 41 students participating in this survey. Thirty-seven students responded to the questions. After reviewing the responses from this questionnaire, I distributed similar questionnaires after both the second and fourth feedback intervention. To gather information regarding the students' implementation of feedback, I analyzed the PaperRater data reports (as described in the methodology section), comparing the percentiles from students’ initial and final drafts of the assigned writing prompts. Using these methods, I gathered information about the value students place on feedback and the role that feedback has on the revision process.

**Results of Baseline Questionnaires**

The baseline questionnaire was designed to gather information about students' current perceptions and experiences with feedback. Before taking the survey, students were told to think of feedback they had received from any of their teachers, about any writing assignments, not
merely their current instructor or their current writing assignments. Specifically directing the students to consider all forms of writing feedback they have received, from any teacher, ELA and non-ELA, allowed for students' general perceptions to be viewed, rather than narrowly colored by their experiences with one particular instructor. Asking students to consider any form of feedback also served to determine what forms of feedback students most often received, across-curricula well as in other ELA courses. Up until this research, it was unlikely that students could have used their current ELA experiences to reflect on received feedback; the students had received little feedback on their writing. The English III curriculum was designed to be focused primarily on oratory skills, thus limiting the amount of feedback students would have received on writing as there was little analytical or argumentative writing in the first semester of the course. The 41 students participating in the study were asked to rate the quality of the teacher feedback they have received in the past, how valuable they felt this feedback is to their revisions, how accurate this feedback was according to their writing strengths and weaknesses, and how many times they currently revise their writing. Students were also asked what types of feedback they currently received and the benefits or drawbacks of that feedback. From this data, different patterns emerged.

In regards to students' values of feedback, a clear, positive correlation was made. When asked "Overall, my teachers provide me with ____ feedback on my writing?" over 75% of the 37 responders felt they were in the 4-5 range, on a 5-point scale with 1 denoting "Low-quality feedback" and 5 denoting "High-quality feedback" (see Figure 1). This response shows that the majority of students who responded thought the feedback they received from teachers had value and strong substance. To clarify the feedback quality students perceived, I also asked whether this feedback encouraged students to revise their writing.
Asking students to rank to what degree they thought their received teacher-feedback encouraged revisions clarified the perceived usefulness students placed on the received feedback. When asked "On the whole, my teachers provide feedback that ___?" 57% of responders felt the feedback was in the 4-5 range, with 1 denoting "does NOT encourage me to revise my writing" and 5 denoting "encourages me to revise my writing." The remaining 43% of students felt the feedback was only partially encouraging in regards to revisions. This percentage shows that although students perceive their teacher's feedback to be valuable, almost 25% fewer students perceive this feedback to be valuable for revising or improving their writing. This data reveals that students have differing opinions on what makes feedback valuable (see Figure 2).
To clarify and quantify these differences, I asked students to provide insight on the benefits or drawbacks they found in the feedback process. This aspect of the questionnaire narrowed down the generalization of "valuable feedback" to key strengths and weaknesses. By allowing students to identify the benefits and drawbacks they find with feedback, students' understanding of how they could use their received feedback was revealed. The primary benefits of teacher-provided feedback revolved around students knowing what changes they need to make to fix their mistakes or to improve their writing. Eight of the thirty-seven responses included the word "fix" in their response, and 20 out of 37 mentioned that teacher-provided feedback identifies how students can improve or what they can do to improve.

However, students identified some drawbacks to teacher-provided feedback as well. Nine of the thirty-seven responses discussed drawbacks of teacher-provided feedback. Three of the responses identify the negatives of teacher bias towards students or the fact that teacher-provided feedback is only from one person rather than multiple (as the case with peer feedback might be). Three responses discuss how the feedback changes the main point students intended or that feedback provided on assignments students have done poorly on voids their desire to read or

\[ \text{Figure 2. Student perceptions of teacher-provided feedback and its ability to encourage revisions} \]
implement the feedback. The final three responses make a note of a disadvantage that having a human providing feedback can pose, whether the teacher has the time to provide truly valuable feedback that makes the students feel the teacher cares about the students’ writing or that goes into detail. One of these responses also mentioned how teacher-provided feedback usually comes after the assignment is due, removing the possibility of improving immediately from the feedback. With many of the drawbacks, and benefits focused on the potential of revision and improvement of writing, both for a grade and for the skill, the final questions of the baseline questionnaire asked students to identify how they implemented their teacher-provided feedback and how long it typically takes for them to receive feedback.

Although the majority of students said the teacher-provided feedback was high-quality and encouraged them to revise, the number of times that students revised their work was relatively small. When asked “When writing assignments that are a paragraph or longer in length, I generally revise my writing about __?” 67% of students that they revised their work 1-2 times total. With an additional 27% answering 3-5 times. For some students, revising one or two times may result in strong development of ideas and implementation of feedback; for some, this might result in minor changes, such as adding of commas or changing word choice errors, which would clarify the readability of a piece. Depending on what revisions are made and the writers’ skill level, 1-5 revisions would be acceptable. While proficient writers may require only one revision cycle, partially proficient or struggling writers might require multiple revision cycles. This question did not address the more valuable aspect of revision, considering not the number, but the depth of revisions. Unfortunately, this question also did not delineate these types of revisions or provide an option for the students that did not revise their writing at all. One student completing the baseline questionnaire stated, "What do you want me to put if I don't revise my
writing? I'm just going to put 1-2 times, okay?" A non-revision option would likely only lower the number of 1-2 time revision responses; with this knowledge, I determined 1-2 revisions to be a low number. The other flaw with this line of questioning was that students were not asked to explain what their definition of revision was. For students who make multiple small revisions, such as the commas or word choices, they might need to revise more times to see the same improvement that students who make more intensive organizational or stylistic revisions.

Considering these various extents of revision, more valuable and enlightening questions would have inquired about what type of revisions students make and the time students are given for revising. Knowing whether teachers gave students time to review and implement the feedback and how much time students received were previously unconsidered aspects of students’ experiences with feedback. Additional unconsidered aspects are whether students received feedback intended for immediate implementation with current writing or for future writing.

Considering the workload many teachers are under, particularly English teachers, it was important to determine how the amount of time it took for students to receive feedback from teachers correlated with students' perceptions of quality and encouraging feedback. Presumably, the time for high-quality, revision-encouraging feedback would have a longer return time, depending on the length of the writing assignment. When asked "When I hand in writing assignments that are a paragraph or longer in length, I generally get the feedback/grade back from my teacher?" 24% of students responded 1-2 days (see Figure 3). While many writing assignments in the ELA classroom are longer than a paragraph, this measurement was chosen to account for feedback students have received from non-ELA teachers. Additional questions to determine the correlation, if any, between the length of the assignment and the length of time to receive feedback would have been a valuable line to pursue. With 59% of students responding
between 1-5 days, this could imply that either students are submitting shorter pieces to receive feedback on, or their teachers do not require an extended period of time to provide feedback.

![Pie Chart]

**Figure 3.** Length of time to receive teacher-provided feedback

Accounting for the variables of the number of students, length of assignment, and depth or quality of feedback, 1-2 days represents a relatively quick amount of time to provide feedback. While a 1-2 day turnaround could correlate with students who cited a lack of specific or detailed feedback as drawbacks of teacher-provided feedback, this was not the case. The students who cited the shortest return times consistently identified similar values to feedback that was returned three or more days after the assignment was turned in. These students' also responded that this feedback was likely to encourage them to revise, choosing 4 or 5 on the 5-point scale, with 5 being encouraged to revise. The students who cited short return times and encouraging feedback were also the 9 out of 12 students who said they revised 3 or more times. Therefore, perhaps the amount of time between turn-in and feedback is not an integral factor in the correlating value of that feedback, but a contributing factor for students' willingness and feeling of encouragement to revise.
The implication that the length of time it takes to receive feedback inversely affects students’ willingness to revise correlates with the data from students who cited three or more days to receive feedback. For the 49% of students who said they receive feedback within three days to a full week later, the value students perceived from teacher feedback was similar to the students who responded with a 1-2 day turnaround. However, these 18 students ranked their feelings of encouragement to revise in the 2-4 range, with only one student responding that this feedback encouraged them to revise. This decreased perception of encouragement appears to confirm the implication that as the length of time increases, students feel less encouraged to revise their writing. This decrease could be impacted by a variety of factors. First, as the time between completing and revising the writing increases, student's overall engagement and focus on the writing task could also be decreasing. Without consistent exposure, the purpose and expectations of writing could be lost. Second, the feedback students receive could be presented in a summative manner, with revisions for the current assignment being optional rather than required, and the main intent of the feedback being to improve the next writing task. Receiving feedback three or more days later implies that the task is either constructed for an extended (multiple weeks or more) time or was a summative assignment to show learning, where the feedback would then be used for future writing.

**Results of Mid-Intervention Questionnaire**

After students had the opportunity to interact with the PaperRater feedback on two writing prompts, I distributed a questionnaire to determine how students perceived the computer-generated feedback they were given. Overall, from the quality of the feedback to how encouraging students found the computer-generated feedback to be, students were neither completely disappointed nor completely satisfied with the computer-generated feedback they
received. When asked what value they would place on the computer-generated feedback PaperRater gave them, on a scale with 1 denoting "low-quality feedback" and 5 denoting "high-quality feedback," 87% of students ranked their feedback with either a 3 or 4. This percentage implies that although students found value in the feedback, these values differed from those they attributed to teacher-provided feedback (see Figure 4). More students ranked computer-generated feedback in the 3-4 range, while they had ranked the quality of teacher-provided feedback in the 4-5 range.

Figure 4. Comparison of Teacher-Provided and Computer-Generated Feedback

The perceived higher value of teacher-provided feedback versus computer-generated feedback could be attributed to students' familiarity with teacher-provided feedback and the previously unseen format of computer-generated feedback. Specifically, teacher feedback typically takes the form of comments at specific places in the writing, usually in the margins. The formatting of the computer-generated feedback consisted of a sidebar on the right side of the text. At first glance, only spelling, grammar, and word choice suggestions were highlighted. To reach the computer-generated feedback more in line with typical teacher-provided feedback, the writer must click on a specific tab in the sidebar; once the suggestions bar pops out, the feedback can be view by clicking left or right in the sidebar. This clarification could also be attributed to
students' willingness to review and understand the feedback PaperRater provided. While it first appeared that students took more steps to view the computer-generated feedback, the process is comparable to a student having to turn to different pages of their writing to find teacher-provided feedback. However, students were also more willing to revise from their teacher-provided feedback than their initial computer-generated feedback (Figure 5). After two writing prompts, in general, students were less willing to revise with the computer-generated feedback. Overall, teacher-provided feedback was considered to be moderately encouraging (3-4 range) by 81% of students who responded, while 68% students thought computer-generated feedback to be in the same 3-4 point range. Again, students were asked to outline benefits and drawbacks of computer-generated feedback, allowing for a deeper understanding of these lower ratings.

![Comparison of how willing students are to revise their writing](image)

**Figure 5.** Comparison of Students’ Willingness to Revise

**Results of Students’ Implementation of PaperRater Feedback**

When students submitted their writing to PaperRater, they received feedback in many categories: spelling, grammar, word choice, style, and scholarly vocabulary. From these categories, PaperRater provided a score and percentage for bad phrasing, vocabulary,
transitions, average sentence length, and grade. Because PaperRater’s feedback for sentence length was rather limited compared to other writing skills and includes the caveat that an optimal sentence length does not exist, I focused on the feedback about bad phrasing, vocabulary, transitions, and the overall grade. The meaning of the scores varies from category to category, for example, the lower the bad phrase score, the better but, the higher the transition score, the better. Because of this variance, the most logical method of determining changes was to evaluate the percentage, or percentile ranking. To measure this data, I averaged the baseline and final submissions from each of the prompts. The percentages gathered from the baseline and final submissions served to quantify how effectively students implemented their computer-generated feedback and how willing they were to revise. By comparing the first and last submissions, the data focused on the depth of the revisions made rather than the number of revisions made.

Looking comprehensively, both the baseline and the final averages showed varied, but consistent, growth in the categories of bad phrasing, vocabulary score, transitions, and grade (Figures 6-9). These categories were chosen to show how willing students were to revise and to what degree their writing improved. PaperRater measures these categories and converts them into percentiles, showing how students compared with individuals with their grade level peers. The feedback for bad phrases includes suggestions for strengthening writing, including identifying weak words such as "bad, stuff, really, etc." It also considers the quantity of spelling errors, as well as clichés and other banal words or phrasing. As a teacher, this category provides valuable feedback for students who struggle to write academically or to choose the strongest word rather than using "very" multiple times in their writing. The vocabulary category, which also shows small gains from prompt to prompt, provides feedback on the students' academic and implementation of refined language, an essential focus of formal writing topics in senior high
English classes. This percentile score is based on the quality and number of scholarly vocabulary words; academic vocabulary can include active or strong verb choice over passive voice or frequent reliance on helping verbs. Transitions, a skill explicitly taught and implemented in my school's English III curriculum, aid in organization and writing flow and it has been a skill this year's students have struggled to master. The feedback *PaperRater* generates identifies commonly used transitions within the writing sample and provides suggestions for transitions students can incorporate. The baseline percentiles show that students were implemented transitions for frequently and successfully than either of the previous categories. The data also shows that from baseline to baseline, students maintained these skills, with the baseline percentiles consistently improving.

The final category, the grade, roughly estimates the score a student would earn based on the categories outlined prior. If the teacher were grading solely on language and style, the grade percentages show that students' scores improved by almost five percentage points. The grade *PaperRater* assigns is also contingent on the student identifying the genre of writing they of their piece. The data *PaperRater* does provide gives specific guidance at the micro level, focusing on wording or sentence structure rather than content or overall essay structure.
From the beginning to the end of the intervention, students’ average bad phrase percentiles showed an 8% growth. From baseline to baseline, these percentiles were not maintained from prompt to prompt, suggesting that students were not able to transfer these skills from prompt to prompt. However, with the exception of prompt two’s final percentile of 28.1, the final percentiles did show growth, nearly consistently improving from prompt to prompt. Therefore, while the percentiles remained low in comparison to other grade 11 writers, the computer-generated feedback helped students remove or replace too-frequently-used phrases,
misspellings, or other inappropriate words. These percentiles also suggest that bad phrasing would be an area that could benefit from more targeted instruction in addition to computer-generated feedback. This increase suggests that students were willing, or able, to implement the computer-generated feedback they received. With the exception of Prompt Three, the baseline averages for bad phrasing stayed within a 3% range. This range suggests that students marginally transferred their improved writing skills from the rough draft of each prompt to the next baseline. Applying knowledge gained from one task to another similar, but different task would help show that students continue to improve the more they compose and revise their writing.

The vocabulary baselines for all four prompts were quite varied, with two being 30% or lower and the other two 39% or higher; this could be attributed to the prompts themselves, since they have slightly different difficulty levels. However, the final percentiles for these prompts showed large gains. After an initial small growth of 6% for the first prompt, finishing at 33.2%, the other three prompts ended with percentiles of 40% or higher. These percentiles suggest that students were more successful at transferring their vocabulary knowledge from prompt to prompt. This improvement further supports the implication that students were willing to work with the computer-generated feedback they received to improve their percentile for each prompt. Prompt Three’s baseline percentages for both bad phrasing and vocabulary look to be outliers in the data. These outliers could most likely be attributed to the shorter amount of class time students had to compose their rough drafts, as a larger portion of that same class period was specifically directed towards outlining the argument as opposed to primarily producing a rough draft as was done for the other prompts. Nevertheless, for the vocabulary score, the averages showed approximately 18% growth from Prompt One’s rough draft to Prompt Four’s final draft. Except Prompt Three, this category also revealed that these increased averages carried over from
prompt to prompt. The subsequent baselines were either higher than or comparable to the
previous final draft averages for Prompts One, Two, and Four. These averages suggested that
vocabulary and strong word choice was an easily transferred skill and perhaps, one that
computer-generated feedback is more effective at improving. These increases also indicated that
students found this feedback helpful in their revisions, however not as much so as the feedback
for the transitions category.

For the baseline, or rough draft, of each prompt, the transitions category showed the most
consistent increases from prompt to prompt; the averages for the final drafts also showed steady
improvement. The final percentiles show that for the first two prompts, there was slow but not
huge gains, with the final percentiles scoring within 1% of each other. Prompt three showed a
huge jump of 20 percentile points from baseline to final; this could suggest that students were
focusing on this category during the third revision cycle. From Prompt One’s baseline to Prompt
Four’s final draft, students’ transitions average percentiles increased approximately 23 percentile
points. This development suggests that students were able to take the feedback they received
from their previous writings and not only apply it to that prompt’s revisions, but also apply the
computer-generated feedback to other compositions. Using these skills across different writing
tasks and can proficiently making changes to their current writing once feedback is received
exemplifies two key purposes of feedback, suggesting students found the feedback regarding
transitions to be understandable and valuable to their writing.

*PaperRater*’s assigned grade percentage showed the least amount of growth from Prompt
One to Prompt Four, maintaining a sort of stability. However, for Prompts One and Two, these
percentages are not accurate. When submitting their drafts to *PaperRater*, students needed to
choose the type of writing, we used “essay,” in addition to identifying their grade level. On
Further investigation, I determined that the students who chose "essay" received a letter grade and percentage; those that failed to complete this step did not receive this data with their feedback. The grade category suggested that while students experienced growth in other categories, these improvements did not necessarily translate into a high overall grade as PaperRater’s grading system considers. However, marginal improvements between the baseline and the final drafts of each prompt imply that students were consistently willing to attempt revisions. The implication of this willingness suggests that students could have become more encouraged to revise, or at least as willing to revise, as they grappled with their computer-generated feedback.

**Results Students’ Schoology Revision Rubrics**

While PaperRater assessed the growth of students’ writing skills, the revision rubric determined to what extent students were willing to revise. While the number of students’ drafts was recorded by PaperRater, the instructor analyzed: students' willingness to revise, use of technology in revisions, and overall improvement. Students were assessed in these three categories via the Revision Rubric, which was comprised of a 5-point scale, ranging from Novice, Partially Proficient, Meets Expectations, and Exceeds Expectations. These scores were stored in the Learning Management System (LMS) Schoology. Schoology has the capability of recording, storing, and measuring students’ mastery of identified learning objectives. It was also the tool used to store the students’ overall writing skills.

As students became acclimated to the revision process—viewing, analyzing, and implementing PaperRater’s feedback—their willingness to revise rose (Figure 10). This willingness was measured by a combination of the number of times students submitted their revisions as well as the rise of their PaperRater scores. To earn a proficient score or higher, the criterion was that students showed a willingness to revise their writing by composing 1-2 new
drafts of their writing. The steady increase of proficient and advanced scores for this criterion shows that students willingness to revise increased as exposure to computer-generated feedback continued. These increased scores suggest that as students adjusted to the idea of computer-generated feedback and practiced applying their received feedback, they became more willing to revise. These scores also suggest that students were able to maintain their willingness to revise and revision skills from prompt to prompt. A corresponding criterion to students’ willingness to revise was their use of technology in revisions.

![Comparison of "Willingness to Revise" Criterion](image)

*Figure 10. Comparison of “Willingness to Revise” Assessment Criterion*

Students appeared to become more comfortable using the technology, digging into the feedback and more competently applying PaperRater’s recommendations (Figure 11). With the goal of gaining a "Proficient" rating or higher, students appeared to strive to improve as writers throughout the writing intervention. A majority of the participating students reached proficiency by the fourth prompt. To reach proficiency, students needed to show they had updated their writing “in response to ongoing feedback, including new arguments or information” and show these developments by submitting two revision reports (Appendix I). This increased percentage of proficiency meant that students revised their work multiple times. When students revised their
work, they improved in several of the PaperRater assessed categories. The data gained from the Revision Rubric suggested that students were not only able but willing to apply the received computer-generated feedback. The data also suggests that students became more proficient at using technology, maintaining and improving their use of technology from prompt to prompt.

![Comparison of "Use of Technology" Criterion](image)

**Figure 11.** Comparison of “Use of Technology” Assessment Criterion

One shortcoming of PaperRater was that the compiled data only represented the data that students submitted; determining students’ willingness to revise was difficult to assess for the students who did not typically submit multiple drafts to the provided dropbox code. In this way, students were in control of the improvements that PaperRater would store and that the teacher could view later. As the improvement from the revisions became more important than the number of times students revised, the data of the number of drafts was bolstered by casual observation during revision days. Students who were more willing to revise were the students, focused on their computer, on switching back and forth between the feedback and their draft over talking with their peers.

**Results of Post-Intervention Questionnaire**
Overall, student perceptions appeared to lean towards computer-generated feedback more favorably as the writing intervention continued. While students’ final perceptions of computer-generated feedbacks’ quality continued to stay lower than their initial perceptions of teacher-provided feedback, perceptions of computer-generated feedback did improve (Figure 12).

**Figure 12. Comparison of the Quality of Teacher-Provided and Computer-Generated Feedback**

At the conclusion of the study, students identified an increased perceived value of the feedback *PaperRater* provided. By comparing the final responses with the mid-intervention, student responses suggested that students either began to understand the feedback they received, became more comfortable working with the feedback, or a combination thereof. It is important to note that although student perceptions of computer-generated feedback remained lower at the high-quality value, student perceptions did rise with continued use of computer-generated feedback. Also, more students ranked computer-generated feedback 4 on a scale of 1-5, just under high-quality. At the conclusion of the study, no students perceived that the computer-generated feedback was of low quality. This conclusion appears to support the theory that
students found the *PaperRater* feedback more appealing or understanding than they did previously.

To understand the increase in positive perception regarding the value of the computer-generated feedback, students were asked: "In what way was it [the computer-generated feedback] low- or high-quality?" Students perceiving the feedback as high-quality reported that *PaperRater* gave feedback in multiple areas. The feedback helped students with their grammar, sentence structure, spelling, transitions, and word choice. Overall, 82% of the students who provided a response to this question included a variation of the feedback giving good suggestions, specific suggestions and details of what worked and what didn’t. This percentage suggested that the computer-generated feedback fulfilled its purpose of recommending changes to students while identifying skills that were proficient or could use some development. This percentage also suggested that many students made an effort to analyze the feedback they received, reading carefully to determine what categories they were both proficient and lacking in. With only 18% of the comments referring to how the feedback was low-quality, the most common response was that students either felt they changed “a lot, ma[d]e all the corrections and it [the paper] would stay the same,” or that *PaperRater* did not provide good content feedback. The perception of making corrections but with no percentile changes could be affected by the actual revisions these students made. For some categories, students could make small changes and see percentile improvements. For other categories, students would need to take the general feedback *PaperRater* provided and apply these recommendations throughout their paper. Throughout the study, the lack of content-based feedback was a potential concern. For the study's purpose of determining perceptions of computer-generated feedback, students were made aware of this shortage in the feedback. To supplement the lack of content-based feedback, the introduction of
each of the prompts included a discussion and brainstorming session to both clarify the intended topic and to allow students to develop their claim. Interestingly enough, students also shared that a lack of content-specific feedback was a drawback of teacher-provided feedback.

After determining the perceived quality of the PaperRater feedback, students were then asked to identify how encouraging they found this computer-generated feedback to be. In response to the question “The computer-generated feedback ____” with one being “did NOT encourage me to revise” and five being “encouraged me to revise my writing,” students’ final perceptions had become more positive as they worked with the PaperRater feedback (Figure 13). Students found the computer-generated feedback to be a combined 18% more encouraging after four opportunities to revise compared to after only two prompts. Student perceptions after four prompts were also comparative to their initial perceptions of teacher-provided feedback. 57% of participating students ranked feedback to be either a four or five on the five-point scale, while 52% of students ranked PaperRater as equally encouraging after the completion of the fourth prompt. This finding suggested that students valued the feedback they received. A comparison of the mid-intervention and final intervention percentages also shows that students' perceived feelings of encouragement rose 7% over the course of the last two prompts. This increase suggests that as students continued to receive and apply the computer-generated feedback, they became more proficient at understanding what suggestions and recommendations PaperRater offered.
To determine the extent of the overall value of PaperRater, students were given asked to respond to the statement, "Overall, the computer-generated feedback helped me improve my writing skills," with one of five choices. The vast majority of responses felt that they improved their writing skills over the course of the study (Figure 14). While 100% of students responded that they revised in some manner, it is important to look at the extent of improvement they perceived. Seventy-nine percent of students chose one of the choices saying, “Yes” they had improved. Only eight percent of students responded that they could apply these writing skills to other general writing. Remembering the maintained writing skill levels previously discussed, this suggests that students recognize improvement but remain unsure of their true writing skill. Forty-six percent of those who participated said they "revised [their] work and [were] able to improve [their] writing.” This suggests that the computer-generated feedback was fulfilling one of its
purposes: to provide suggestions for students to improve their writing. One-fourth of students shared that they were able to revise, but wished their feedback would address content as well. This response correlates with the perceived factors discouraging students from revising and with the quality of the computer-generated feedback. Another perspective is that 52% of students responded in the affirmative and admitted that although PaperRater didn’t give them all the feedback they were looking for, they were still able to find specific value in the computer-generated feedback. These responses suggest that continued use of PaperRater could help students gain and maintain more general, rather than prompt specific, writing confidence. The remaining 46% of students made some (or more) of the suggested changes, but focused more on what the computer-generated feedback didn’t do rather than what PaperRater was able to help with. These responses serve as a reminder that computer-generated feedback is not fully equipped to replace teacher-provided feedback in all senses, or that students have fully bought into the purpose of computer-generated feedback.

**Student Perceived Improvement of Writing Skills**

- **I made no improvements.** 25%
- **I made some of the suggested changes.** 21%
- **Yes. I revised my work, but I wish it would help me with revising my content as well.** 8%
- **Yes. I revised my work and was able to improve my writing.** 46%
- **Yes! I revised my work and I improved. I know that PaperRater doesn’t look at content, but I can apply these writing skills to other writing tasks that aren’t specific to an assigned prompt.**
A final question for students pertained to the perceived benefits and drawbacks of computer-generated feedback. All students reported revisions to some degree, with the majority responding that they perceived improvement in their writing. The vast majority of the responses showed students found value in the computer-generated feedback, with 79% of students citing improvement. While this majority believed that the computer-generated feedback did help, there were some recognized disadvantages. Thirty-three percent of the responses identified a desire for more specific feedback regarding content and writing style. When provided the opportunity to elaborate on their perceptions, of the 18 comments describing disadvantages of computer-generated feedback, 61% of these identified the lack of content-focused feedback. These responses reiterate the perceived quality and degree of encouragement of computer-generated feedback. These comments suggested that content is a great concern for many English III students. One student epitomized this concern, stating that after teacher-provided feedback was reintroduced, that “we will not know what is expected [from her] because we have gotten used to an entirely new grading system with different feedback.” This comment presents the question of how this student has previously experienced feedback. With this description, feedback appears to be a summative feature of this student’s writing experience. The phrase “entirely new grading system” supports a summative aspect of feedback. This student’s response suggests that the purpose of implementing PaperRater was either not effectively explained or understood, as feedback was given and applied days or weeks before the entire composition was assessed.

Of the 21 comments about benefits of computer-generated feedback, 52% focused on the immediacy of the feedback. Compared to the one-two day turnaround minimum of most teacher-provided feedback, the immediacy of feedback presented a key advantage of computer-generated
feedback for students. Additional benefits were that PaperRater’s feedback was specific in skill and suggestion. The specificity of feedback was a comment on both the positive and negative perspectives. As a benefit, students reflected that the feedback was helpful when “trying to figure out what exactly to change.” As a drawback, one student indicated "it [the feedback] doesn't help you out on how to fix your writing." These conflicting comments, both focused on the specificity of the computer-generated feedback, could be explained by the time students took to revise their writing. For students who read all of the suggested feedback, they might have felt more prepared to decide how they could improve certain categories. For students who felt the feedback was not specific enough, perhaps they did not scroll through all of the feedback, or they were not effectively prepared to understand and breakdown to which skills and portions of the writing PaperRater’s feedback referred.

**Discussion**

After analyzing data to identify implications for future implementation of feedback and additional research, both conclusions and new questions have developed. Microsoft Word's spell and grammar check provide some immediate feedback for what works and what students should change, but on a limited level. For some students, this was the only form of editing or revision they apply to their writing.

From this study’s data, while computer-generated feedback might not be perceived to be more valuable, it can be concluded that it could be beneficial for improving students’ writing skills. For this study, students incorporated and applied computer-generated feedback from PaperRater. Overall, students showed improved skills in the categories of bad phrasing, vocabulary, and transitions, as the data reports from PaperRater showed. According to the data from the Revision Rubric, students became more comfortable and willing to revise their writing
as they continued to have the opportunity to revise using computer-generated feedback. From the pre-, mid-, and post-intervention questionnaires, students showed an improved sense of encouragement from computer-generated feedback, comparable, but not greater, than that of teacher-provided feedback. In conclusion, students felt the computer-generated feedback they received benefited their writing, with the data confirming improved writing skills and correlating with these positive perceptions.

Many digital tools and sites, like PaperRater, provide anyone with knowledge of and access to the resource with the opportunity to get feedback before publication or posting, on a deeper level than previously available. In a world of increasing immediate gratification, these digital tools provide deeper-level feedback at the same pace students get other information: nearly immediately. Beyond increased immediacy, implementing computer-generated feedback has other multiple implications for the classroom.

**Implications for Students**

With the introduction of computer-generated feedback, students began to more actively think about how they were writing as equally as what they were writing. For many students, composing one draft was previously adequate: they didn't care what grade they got or how eloquent they were. Some students got the assignment done, as the student who asked what he should respond if he didn't revise his writing while completing the baseline questionnaire. Adding in the element of seeing what their grade would be, approximately, using PaperRater caused some of these same students to engage in the feedback and revision process. From my casual observations on revision days, students wanted to improve their writing; mainly, they wanted to see that score improve, as the PaperRater data showed. For example, during Prompt Three's revision day, one student crowed when he saw his score rise from a 68% to a 71% on
PaperRater's grade scale. The PaperRater reports pulled after final essays were turned in showed that over 70% of students revised their writing. Some of these revisions resulted in marginal gains, while other students raised their PaperRater grades a letter or two. A future study might seek to find out the differences between the high growth and low growth students and how they used the feedback.

The efficacy of computer-generated feedback for students would first rely on the teacher's presentation and engagement of student buy-in. As could be seen with students' concern in relying on technology to at least partially aid in assessing writing, outlining the formative benefits of computer-generated feedback should be emphasized, particularly when introducing a computer-generated feedback tool to students. Students' understanding of the limitations of computer-generated feedback would need to be clarified to ensure students also understand that this resource would not necessarily replace the teacher's position, but supplement or complement this role, and that of peer feedback. As the literature discussed, there are many forms of feedback in regards to delivery and specificity. Some students felt that the computer-generated feedback was not specific enough. Students also responded that a drawback of teacher-provided feedback was the length of time that elapsed in receiving feedback. Specificity and immediacy can be contradicting factors in providing feedback; computer-generated feedback can alleviate some of these student-identified expectations in feedback.

Computer-generated feedback also presented a great learning opportunity for students. Rather than waiting to be told how to improve, students could take the initiative in their learning and develop their writing skills independently. It changes students from a more passive role regarding feedback to an active role and increases student independence. Students' repeated comments regarding feedback on content presented some concerns. These observations
suggested that students are concerned not necessarily with their writing proficiency, but with their ability to stay on topic or to effectively communicate in a coherent style. The focus on content could pertain to students' concerns of a clear and structured argument. The focus on content could also relate to students' concerns of not writing their opinions, but giving the teacher what he or she expects. If the concern is based on the organization and development of writing, teacher-provided feedback could and would be valuable. If students are primarily fixated on the latter concern, they are more concerned about getting a good grade than showing their understanding. This concern implies that students maybe complacent in developing opinions and clearly relating these opinions; rather, they are more focused on the grade the task represents than the process represented. With the student responses concerning students desire to have feedback specific to the content of their writing, a future study could also look at the effect of combined teacher- and computer-generated feedback.

**Implications for Teachers and Teaching Practice**

After analyzing the baseline and post-intervention questionnaire responses, I recognize that many students did not know how to engage with and apply computer-generated feedback. Where previously teacher-feedback explicitly told students what they did wrong and where, as well as what they could do to improve their writing, PaperRater focused on the students' writing overall. This change of delivery required students to actively recognize where in their writing they were weak and to think about how to make the suggested changes. For many students, identifying these errors or implementing the recommended changes was difficult, likely due to their learned dependence on teacher-provided feedback. Many times during revision day, by reviewing the feedback one-on-one with students, these individuals were then able to understand what potential changes they could make. In the future, I plan to develop help guides or videos for
students to independently access, explaining how to apply the feedback they receive. These supports would help students make revisions based on the feedback they receive.

This research has confirmed my perception that feedback is a multi-faceted tool. Computer-generated feedback cannot, and should not, replace teacher-provided, or even peer-provided feedback. As students responded, "computers can't understand context." *PaperRater* expressly provides feedback on style and structure but does not address the context or content of the writing. In a classroom, this aspect of feedback remains integral to developing proficient and advanced writers.

However, computer-generated feedback does ease some of the pressure on teachers. In reading students' writing throughout this action research, I found that readability increased. Grammar, spelling, and punctuation errors decreased. If I had also needed to provide feedback on these prompts, I would not have had to focus my feedback on these categories as much, freeing me to focus on the content of the writing, as my students remarked upon. As the *PaperRater* data corroborates, transitions and word choice improved, as did the variety of sentence beginnings. While I did not provide individual feedback to my students during this study, I spent more of my grading time looking at the structure of students' persuasive arguments, their claims and supporting evidence.

The task of grading for style and language, which non-Language Arts departments typically do not include in their grading, was lessened. Implementation of tools like *PaperRater* in non-Language Arts classrooms would encourage students to apply metacognitive skills to their writing, developing their self-assessment skills. Often, non-ELA teachers remark that they don't want to assign writing because they don't know anything about grammar. Implementing a computer-generated tool such as *PaperRater* could lessen these concerns. Each subsequent
baseline was higher than the previous rough draft’s scores; similarly, each final draft’s averages were also higher than the previous final drafts. The combined approach presented earlier could be a viable solution to encouraging student revision independence rather than teacher-dependence. In theory, the combination would provide immediate, computer-generated feedback the students need regarding structure, which would also potentially give the teacher more time to address the content of student writing. This entire process would not need to be implemented with every piece of writing students compose, but strategically to assess students’ writing development.

**Future Research**

Questions about the implications of multiple tools and categories of feedback developed from this research. How would students' writing skills be impacted if they received individual-specific feedback regarding both content and style/language (readability)? How would students' writing skills be affected if they received computer-generated feedback regarding both content and readability? How would computer-generated feedback compare to teacher-provided if increased student-based learning was a classroom goal?

Tools such as RevisionAssistant provide feedback, albeit for only a limited number of topics, based on content and structure. How would students' writing evolve if, at the beginning of the year, teachers introduced students to both RevisionAssistant and PaperRater? Would these changes be greater than or equal to when content and macro-structural feedback were presented, such as provided by RevisionAssistant, at the beginning of the year? What would the effect of removing supports gradually until students were primarily receiving language and style-specific feedback, such as provided by PaperRater? Grade- or ability level is another consideration. How would students' writing improve over the course of their academic careers if they began with
content-specific feedback in their freshman year, with the removal of structural supports resulting throughout multiple years of school rather than a single school year?

Overall, technology offers many opportunities for both teachers and students. However, the extent, efficiency, and efficacy of these technological tools must be considered and thoughtfully integrated to ensure student development. Feedback, whether formative or summative, should be focused on improving skills. In a constantly evolving field, new tasks, focuses, requirements, and responsibilities are consistently added to the teacher's role.

Technology could be an especially valuable tool in the classroom. In a world constantly evolving from new technologies, to not take advantages of the learning opportunities and boosts technology can provide is a disservice, for both students and teachers. The task of a teacher is to prepare students for "the real world," where feedback is not always readily available; to provide students even one tool to aid them in developing as competent writers, would benefit students. As the research shows, technology tools such as computer-generated feedback only improves student efficiency with technology and reinforce the willingness and motivation to continue learning.
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Appendix A
Student Consent Form

Student Roles & Expectations for PaperRater Process

What: Ms. Peterson will be researching how computer-generated feedback impacts the value that you as students find in feedback.

Why: Teachers sometimes have a hard time keeping up with giving valuable feedback to all of their students. Without purposeful feedback, you don’t have a clear direction to work on improving your writing. Ms. Peterson is going to look at how computer-generated feedback, like PaperRater, affects your motivation to revise your writing.

What we’ll be doing in class:
1. Reflecting on our past experiences with teacher and peer feedback using a data collection form.
2. Begin drafting a writing response (we’ll do this multiple times, so I’m not going to refer to a specific prompt here).
3. Before the final due date, we’ll take a day for edits and revisions. This time, instead of handing in your work for teacher or peer edits, we’ll get out the computers. You’ll complete a PaperRater revision assignment, which I will guide you through the first time.
4. You’ll get immediate feedback from PaperRater and have a chance to begin revisions on your writing.
5. After we hand in our final copies, you’ll reflect on your experience with another data collection form.
6. We’ll be incorporating PaperRater multiple times, to see what the extended effect is on our writing skills.

Time Commitments:
1. Outside of class: your usual amount of time spent drafting, editing and revising, and polishing your writing.
2. Inside class: the 30 minutes or so that we typically take for revisions (peer, conferences, etc.) will instead be used to implement PaperRater.
3. We won’t be doing anything beyond what you’re expected to do for writing assignments.

Risks, Benefits, & Confidentiality:
- You don’t get an extra credit or other bonuses for participating; you’d be doing this activity regardless.
- Your name won’t be included in my research.
  - For the data collection forms, you won’t need to provide your name.
  - For the PaperRater submissions, I’ll need your name (to use for class), but in my research I’ll use a pseudonym instead of your real name.
- You’ll get the benefit of immediate feedback and time to apply that feedback to your writing rather than having to wait for a peer or a teacher.

If you and your parents decide you want your data included, you don’t have to do anything.

What to do if you don’t want your data included:
- Discuss your reasoning with your parents AND have them sign the consent form if you don’t want your data included. You get 1 week to talk about this with your parents and have them return the form.
- Sign the contract below and return this form to Ms. Peterson. (You’ll get a copy back for your records.)

Please check the box reflects your participation in this action research study of computer-generated feedback.
- I agree to have my data (reflections on feedback and PaperRater revisions) included in the study.
- I do not wish to have my data (reflections on feedback and PaperRater revisions) included in the study.

_________________________________________ Student Name
_________________________________________ Student Signature
Appendix B

Parent Consent Form

Impact of Computer-Generated Feedback on Student Perceptions of Revision Process

Assent Form

January 5, 2017

Dear Parents,

In addition to being your child’s English III instructor, I am also a St. Catherine University (St. Kate’s) student pursuing a Masters of Education. As a capstone to my program, I will be completing an Action Research project. I am going to study the impact of computer-generated feedback on student’s perceptions of feedback since feedback has been found to be a critical part of improving students’ writing and reflection skills.

In the coming weeks, I will be incorporating computer-generated feedback as a regular part of my writing instruction and feedback methods. All students will participate as members of the class. In order to understand the outcomes, I plan to analyze the results of this writing intervention to determine how valuable incorporating immediate, computer-generated feedback is to student perceptions and willingness to revise writing.

The purpose of this letter is to notify you of this research and to allow you the opportunity to exclude your child’s responses and results from my study.

If you decide you want your child’s data to be in my study, you don’t need to do anything at this point.

If you decide you do NOT want your child’s data included in my study, please note that or this form below and return it by January 16, 2017.

In order to help you make an informed decision, please note the following:

• I am working with a faculty member at St. Kate’s and an advisor to complete this particular project.
• I will be writing about the results that I get from this research. However, none of the writing I do will include the name of any students or any references that would make it possible to identify outcomes connected to a particular student. Data from this study will be kept confidential. In any written reports or publications, no one will be identified or identifiable and only pseudonyms will be used.
• Through your child’s participation, I will learn how I can improve the use of feedback on student writing to help develop your child’s academic writing skills.
• The final report of my study will be electronically available online at the St. Kate’s library. The goal of sharing my research is to help other teachers who are also trying to improve their teaching.
• Participation in this study is completely voluntary. There is no penalty for not having your child’s data involved in the study; I will simply delete his or her response from my data set.

If you have any questions, please feel free to contact me, Ms. Peterson, at epeterson@west-fargo.k12.nd.us or 701-356-2160 ext. 3497. You may ask questions now, or if you have any questions later, you can ask me, or my advisor Kevin Mackin, at rkmackin@stkat.edu, who will be happy to answer them. If you have questions or concerns regarding the study, and would like to talk to someone other than the researcher, you may also contact Dr. John Schmitt, Chair of the St. Catherine University Institutional Review Board, at 651-690-7739.

You may keep a copy of this form for your records.

Ms. E. K. Peterson 1/5/2017

OPT OUT: Parents, in order to exclude your child’s data from the study, please sign and return by January 16, 2017.

I do NOT want my child’s data to be included in this study.

________________________________________ (Parent Signature) __________________________ (Date)
Script for student consent; to increase engagement, students will be given time to read through the description of the project before engaging in a discussion regarding the details and expectations of the project; a dialogue will also allow me to make any clarifications and answer other questions or concerns for students before they decide to consent or refuse consent. Time for student responses and questions is included after each question:

- **“As you know, I’m working on a big project for my master’s degree. Your class is a part of my project. What I’m handing out right now is your role in my project, and some details of how and why we’ll be doing what we’re doing. I’m going to give you a few minutes to read through this information before discussing it with you.**

- **Give students 3-5 minutes to read handout…**

- **Now that you’ve had time to read through your role in this project, let’s talk specifics.**
  - What are the steps of the project? (pause & discuss)
  - Are there any questions about any of the steps? (pause & discuss; clarify where/when necessary)
  - Will you be expected to do anything beyond the coursework itself? (pause & discuss)
  - Are there any incentives for taking part in my study? (pause & discuss)
  - What do you have to do if you’re okay with having your data included? (answer: nothing) What do you have to do if you or your parents don’t want your data included? (answer: talk to Ms. Peterson after class; have parents sign and return the form)

- **Remember: You’ll still be taking part if you or your parents don’t consent, but I won’t use your data in my research.**
Appendix D
Baseline Student Perceptions Google Questionnaire

Traditional Feedback Methods

Students, please complete this survey on traditional teacher and peer feedback. Think generally about the writing you hand in to your teachers (do not think about only one specific teacher).

It is important to be as honest in your answers because I will use the information you provide to help me plan future language arts lessons.

Completion of this survey is voluntary and anonymous. By completing this survey, you are giving your consent to participate in this study. Completing this survey is completely voluntary and you may quit at any time.

Thanks for helping me with this important project.

Ms. P

* Required

1. Overall, my teachers provide me with *
   Mark only one oval.

   1  2  3  4  5
   Low quality feedback on my writing  High quality feedback on my writing

2. On the whole, my teachers provide feedback that *
   Mark only one oval.

   1  2  3  4  5
   does NOT encourage me to revise my writing  encourages me to revise my writing

3. To me, the writing feedback I receive from my teachers feels *
   Mark only one oval.

   1  2  3  4  5
   Inaccurate regarding my writing strengths and weaknesses  Accurate regarding my writing strengths and weaknesses

4. Please provide some general feedback about the benefits or drawbacks of teacher-provided feedback. *
5. What (other) methods of feedback have your teachers employed throughout the writing process? (Check any that apply). *
   
   Check all that apply.
   
   [ ] One-on-one conferences with my teacher
   [ ] Recorded feedback from my teacher
   [ ] Written feedback from my teacher
   [ ] Peer feedback, written or verbal, from one or more of my classmates
   [ ] Checklist or directions for me to provide feedback for my own writing (self-feedback)
   [ ] Visual feedback (screen shots or examples shared in class)
   [ ] I’ve never been provided feedback
   [ ] Other: ______________________

6. Please provide some general feedback about the benefits or drawbacks of the feedback methods you’ve experienced from the above list. *
   
   ____________________________________________

7. When writing assignments that are a paragraph or longer in length, I generally revise my writing about *
   
   Mark only one oval.
   
   [ ] 1-2 times
   [ ] 3-5 times
   [ ] 6-9 times
   [ ] 10-15 times
   [ ] More than 15 times

8. When I hand in writing assignments that are a paragraph or longer in length, I generally get the feedback/grade back from my teacher *
   
   Mark only one oval.
   
   [ ] 1-2 days later
   [ ] 3-5 days later
   [ ] about a week later
   [ ] a few weeks later
   [ ] several weeks later

Thank you for your responses.
Appendix E
Brainstorming a Persuasive Argument Organizer

Use the guide below to generate ideas to support your chosen position.

**Position:**

**Audience:**

**What is your purpose?** To convince readers that __________________________ is __________________________.

**Reasons to support your position:**

1. 

2. 

3. 

**Anticipated Objections:**

What is at least one reason why some people may feel the opposite, or a different, position than you.

1. 

2. 

**How would you respond to that person?**

1. 

2. 
Appendix F

*PaperRater* Revision Process for Prompts 2-4
Appendix G  
_PaperRater_ Prompt & Process

Use the following steps to complete this assignment

1. Use _PaperRater_ link above to generate a 'report' for _your first draft_. Copy and paste your essay, select the education level, select the type of paper, and whether or not you want plagiarism detection. Agree to the terms or service, and click 'get report.'

2. **Submit this report to your teacher** by clicking on 'Where Next' Then click next. In the box under 'Your Name,' put in your name with your last name first (Last, First). Then, type in your email (optional), and add the code listed below:
   --Period x: xxxxx
   --Period x: xxxxx

3. **Make changes** to your draft based on the feedback from _PaperRater_ (Use the 'printable summary report' to get the most detailed information in one place).

4. **Resubmit your new draft report** to your teacher using the same method and code as above.

5. **Repeat as many times as you like** (see rubric as to how you are graded) Obviously, the goal of the revision process is to make the grade improve. Continue to do this, as you add to your draft.

**Keep in mind that _PaperRater_ is GREAT at helping you improve your style and word choice, but it _cannot_ give you specific feedback on your content. That is a part of the revision and research process that must undertake on your own.
Appendix H

*PaperRater* Example Percentile and Score Report
### Appendix I

**Schoology Revision Rubric**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Grading Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Willingness to Revise</strong></td>
<td></td>
</tr>
<tr>
<td>Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.</td>
<td>5 Advanced Student showed a strong willingness to use the technology to improve their writing by composing at least two new drafts</td>
</tr>
<tr>
<td><strong>Use of Technology</strong></td>
<td></td>
</tr>
<tr>
<td>Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.</td>
<td>5 Advanced Student submitted several revision reports, showing score improvements on each</td>
</tr>
<tr>
<td><strong>Overall Improvement</strong></td>
<td></td>
</tr>
<tr>
<td>Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</td>
<td>5 Advanced Student improved sentence style, word choice, grammar, vocabulary, and sentence beginnings based on feedback.</td>
</tr>
</tbody>
</table>
Appendix J
Mid-Intervention Student Perceptions Google Questionnaire

Computer-Generated Feedback 2

Students, please complete this survey on computer-generated feedback.

It is important to be as honest in your answers because I will use the information you provide to help me plan future language arts lessons.

Completion of this survey is voluntary and anonymous. By completing this survey, you are giving your consent to participate in this study. Completing this survey is completely voluntary and you may quit at any time.

Thanks for helping me with this important project.

Ms. P

* Required

1. Overall, the computer-generated feedback provided on my writing was *
   Mark only one oval.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low quality feedback</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

2. To me, high-quality feedback (regardless of computer-generated or teacher-provided) means feedback that is...

3. The computer-generated feedback *
   Mark only one oval.

<table>
<thead>
<tr>
<th>1</th>
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<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>did NOT encourage me to revise my writing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. After reading the feedback, I revised my essay *
   Mark only one oval.

- 0 times
- 1-2 times
- 3-5 times
- 6-9 times
- More than 15 times

5. To me, the feedback comments and overall grade felt *
   Mark only one oval.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inaccurate regarding my writing strengths and weaknesses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Please provide some general feedback about the benefits or drawbacks of using computer-generated feedback to improve your writing *

7. Overall, what makes feedback valuable to you and your development as a writer? *
Appendix K
Post-Intervention Student Perceptions Google Questionnaire

PaperRater Computer-Generated Feedback Post Prompt #4
Students, please complete this survey on computer-generated feedback.

It is important to be as honest in your answers because I will use the information you provide to help me plan future language arts lessons.

Completion of this survey is voluntary and anonymous. By completing this survey, you are giving your consent to participate in this study. Completing this survey is completely voluntary and you may quit at any time.

Thanks for helping me with this important project.
Ms. P

* Required

1. Overall, the computer-generated feedback provided on my writing was *
   Mark only one oval.

   1  2  3  4  5
   Low quality feedback    High quality feedback

2. In what way was it low or high-quality?

3. The computer-generated feedback *
   Mark only one oval.

   1  2  3  4  5
   did NOT encourage me to revise my writing    encouraged me to revise my writing

4. After reading the feedback, I revised my essay *
   Mark only one oval.

   0 times
   1-2 times
   3-5 times
   6-9 times
   More than 15 times
5. **To me, the feedback comments and overall grade felt**
   *Mark only one oval.

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<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Inaccurate regarding my writing strengths and weaknesses</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accurate regarding my writing strengths and weaknesses</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

6. **Overall, I think the computer-generated feedback helped me improve my writing skills**
   *Mark only one oval.

   - No. I didn’t revise my work at all.
   - Kind of, I made some of the suggested changes.
   - Yes, I revised my work and was able to improve my writing.
   - Yes. I revised my work, but I wish it would help me with revising my content as well.
   - Yes! I revised my work and I improved. I know that PaperRater doesn’t look at content, but I can apply these writing skills to other writing tasks that aren’t specific to an assigned prompt.

7. **Please provide some general feedback about the benefits or drawbacks of using computer-generated feedback to improve your writing**

8. **Overall, what makes feedback most valuable to you and your development as a writer?**