

The Effect of Reflective Writing on Multiple-Choice Quiz Scores

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Abstract

Students in Husson University's Spring 2015 CT 150 Intro to Live Sound Technology course are taught in both the traditional lecture and laboratory settings. Some students have difficulty in the lecture environment with its inherent theory, readings, writing assignments, and quizzes. The net positive results of the writing assignments are questionable. The primary writing assignment, which is a short summary of the weekly reading, does not appear to improve quiz scores over the course of the semester with some students choosing not to complete the summary paper at all. This study investigates the impact of switching the weekly summary paper to a weekly prompt-based reflection paper on completion rates and multiple choice quiz scores. The results indicated a slight improvement in writing assignment completion rates in comparison to pre and post-intervention data collected from the study's sample population. A significant increase was found when comparing completion rates from the previous semester to post-intervention completion rates from this study. The study also revealed a slight improvement in mean quiz scores when comparing pre and post-intervention data and data from the previous semester.

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The Effect of Reflective Writing on Multiple-Choice Quiz Scores

As of fall semester 2014 New England School of Communications became a school within Husson University in Bangor, Maine. With approximately 450 students enrolled in a variety of communications majors NESCom provides real-world, high-technology training for aspiring web-developers and designers, video production and film students, audio engineering, live sound and post-productions students, and marketing communications students just to name a few.

A large portion of NESCom students come from career and technical education (CTE) training centers from around the state of Maine and New England. A number of those students have experienced academic success as a result of the hands-on training they received in their CTE classrooms. Those same students tend to struggle in more traditional educational environments, especially at the college level. NESCom teaches students in both a traditional lecture and laboratory classroom. Perhaps not surprisingly, some students have difficulty in the lecture classroom with its inherent theory, readings, writing assignments, and quizzes.

The students in CT 150 Intro to Live Sound Technology, the classroom examined in this research, are no different. In the spring semester 2015 CT 150 course there are thirty-six students between the ages of 18 and 21. Thirty-five of the students are audio engineering majors and there is one video production major that will be graduating in May 2015.

Within the course, besides the formal lecture over each weekly reading assignment students are required to write a short one-page paper summarizing the reading. The net positive effects of the summary papers are questionable. In the past quiz scores have not improved over the course of the semester and some students choose not to complete the summary paper at all. This paper will investigate the validity of changing the weekly paper from a simple summary of

the reading to a reflection paper responding to a specific teacher-provided prompt (see Appendix C) and whether or not that change will result in higher completion rates for the writing assignments and improve students' quiz scores on multiple-choice assessments.

Problem Statement

In fall semester 2014 the average quiz score in this course was 73%. Students are having trouble transitioning information from the weekly readings to the weekly multiple-choice quizzes. In terms of assignment completion only 75% of the class completed the summary paper on a weekly basis, with summary paper one experiencing the highest completion percentage of 91%. As the semester progresses the content increases in difficulty, if students are not completing the writing assignment their chances of scoring high on the associated quiz is quite low and those scores will get progressively worse throughout the semester. The assignment completion rate is not isolated to specific students. In any given week a different group of students may or may not complete the writing assignment. While there are specific students that do the homework every week, the group of non-completers varies. This indicates a possible problem with the writing assignments and not with the students.

Research Question

As the researcher considered how to improve student quiz scores the validity of the weekly summary paper came into question. If students are not completing the assignment they are not properly preparing for the weekly assessment. If students are tasked with a more engaging thought-provoking writing prompt, will the overall completion rate of that assignment go up resulting in improved quiz scores?

Hypothesis

After engaging in more high-order reflective writing, student completion rates of writing assignments will improve and will also result in an increase in quiz scores.

Literature Review

Reflective writing and reflective practice have long been seen as beneficial within education (Ryan, 2011). This review of the literature will explain why and what exactly that value is. The literature review will also define reflective writing as that will help to explain its apparent high value in education.

The literature also answers a few important questions about student engagement with homework and reflective writing. One of the goals of this study is to see if requiring more reflective writing would lead to higher completion rates for writing assignments and whether any conclusions can be drawn regarding the engagement level of reflective writing. It is also the overall goal of this study to show an increase in multiple-choice quiz scores, therefore the literature review will demonstrate evidence that homework and, more specifically, reflective writing improves outcomes.

What is Reflective Writing?

Cisero (2006) analyzed whether or not reflective writing improved course performance. Within that study Cisero defined reflective writing, or in her case journal writing, as a significant interaction with the reading assignment whereby the student applied the content to their own background and experiences, while examining and evaluating the information (2006). Cisero believed that this helped the students foster more meaning from the content rather than simply memorizing.

Cohen-Sayag & Fischl's (2012) definition is similar as they believe the writing and self-reflection stimulates background knowledge and promotes meta-cognitive thinking but add that it also inspired the pre-service teachers they studied to diagnose and solve problems.

Errey & Wood (2011) believe it is important that students think while they are writing and play an active role in their learning. When assignments ask students to answer open-ended questions and to do more than simply search the textbook for the correct answer, active learning is taking place (Errey & Wood, 2011). That sort of learning can happen in or out of the classroom.

McLaren & Webber (2009) studied the result of implementing, in combination with their English and Science departments, a Writing across the Curriculum (WAC) program in an Ecology course. Their initial determination was that the existing writing of their students did not exhibit the necessary comprehension of core concepts nor did it sufficiently communicate knowledge (McLaren & Webber, 2009). While the WAC program covered a number of strategies for improving writing, it is important to note that exit slips and dialogue journals were part of the program (McLaren & Webber, 2009) both of which are examples of reflective writing.

Ryan (2011) believes that reflection drives the student to combine theory with their background and experiences and use it to examine and improve their knowledge and skills. Wills & Clerkin (2009) extend Ryan's definition of reflective writing beyond school and into a student's career. Reflective writing forces students to think about their past and how to use that information in the future (Wills & Clerkin, 2009). Their business school incorporates reflective writing into the classroom through simulation games. The writing required incorporates academic content and application; the games put the students in simulated real-world contexts.

Reflective writing takes students' background knowledge and asks them to assess and appraise it along with new information (Cisero, 2006; Cohen-Sayag & Fischl, 2012; Ryan, 2011; Wills & Clerkin, 2009). On the surface reflection appears to be an engaging form of writing. In the next section the literature will shed some light on student engagement and assignment completion.

Reflective Writing, Engagement, & Assignment Completion

The literature has demonstrated that reflective writing forces students to think, to think about their past (Cisero, 2006; Cohen-Sayag & Fischl, 2012; Ryan, 2011; Wills & Clerkin, 2009), and to think about how existing and new knowledge can be used in the future (Wills & Clerkin, 2009). Cisero's (2006) study of 166 college students posited that engaging in reflective writing may have spurred some students along the path to becoming life-long learners with the understanding that education does not stop at the classroom door or on graduation day. Unless students are learning outside of class it is difficult to engage them to that end. Errey & Wood (2011) note that when students are encouraged to elaborate or reflect on content outside of the classroom it will promote student engagement. Many students will relish the chance to engage in reflection (Everett, 2013).

Clapp (2013) researched the net result of reflective writing on high school biology students. She believes that incorporating reflective writing is a fantastic way to investigate scientific concepts because it engages the mind and challenges students (Clapp, 2013). Wood (2012) was not so convinced. He studied the impact of engagement through reflective writing on nine students from one of his Biology classes. His determination was that student engagement varied from day to day and that other factors played a role in engagement such as amusing and relevant activities and understanding of the information (Wood, 2012). Wood (2012) believed

that on days that the class was engaged it might have simply been because they liked the activity and not because of the reflective writing.

In order to ensure that assignments are engaging homework should not be tedious and there should be a specific reason for the assignment (Carr, 2013). Homework also needs to require thinking for it to be stimulating (Carr, 2013). Carr researched the effectiveness of homework and how teachers could improve assignments and their practices. She was concerned with the increasing number of special needs students in the regular classroom and was researching ways to tailor homework for all students (2013).

Carr (2013) believes that easy assignments inevitably lead to boredom and that homework needs just the right amount of difficulty. She also notes that ownership helps to connect students to the assignment and to the content, which engages students. Reflective writing has those elements. It is an engaging form of writing that encourages students to not only lend their voice to their work, but also offers them the chance to connect new information to what they already know. This improves understanding of material, which Wood (2012) speculates leads to increased engagement.

The literature does not definitively say whether or not engaged students complete their homework more often. It is logical to connect engagement to increased assignment completion but the literature does not say for sure. This study will not specifically look at engagement, though some conclusions may be drawn from the gathered data, specifically the pre- and post-intervention student surveys. This study will only investigate whether or not completion rates increase after changing the current summary paper to a reflection paper. It is still logical, however, to infer that a reflection paper being more engaging as demonstrated by the existing literature will therefore have higher completion rates.

Engagement & Reflective Writing Leading to Outcomes

The next section relates to the effect of reflective writing on academic outcomes. The literature doesn't explicitly mention quiz scores or multiple-choice quizzes. It does however link engagement with outcomes in general. The finding of Cisero's (2006) investigation into reflective writing and course performance show that students that were driven to put the necessary work into the writing assignment had higher grades on their journals and also saw value in the journal writing itself.

This drive or engagement has been tied directly to improved student outcomes (Errey & Wood, 2011) and built on decades of research (McClenney, Marti, Adkins, & CCSSE, 2012). McClenney et al. (2012) analyzed three studies covering approximately 700,000 students. They determined that student engagement and student achievement go hand in hand. They add that the biggest impact stems from using appropriately challenging assignments to engage students. This sort of academic challenge is most often linked to an improvement in outcomes (McClenney et al., 2012).

Related to this is homework, which Epstein & Van Voorhis (2001) investigated when looking at the role teachers play in designing it. Their research revealed that homework that has a particular purpose and precise goal would result in more students completing it and profiting from it. Costley (2013), on the other hand, only talked about homework in general in his research and never differentiated the effects of good or bad assignments. His view was simply that opinions vary considerably when it comes to the effect homework has on achievement while disregarding the quality of the homework assignment itself.

Moving on in the literature to the effect reflective writing specifically has on outcomes and achievement, Cisero (2006) points out that journal writing is most effective for those

students that choose to think and reflect, which makes the process more meaningful for them. This is not to say that the effort of reflective writing is wasted on other students, rather the practice may actually help them develop self-reflection skills or even drive them to expend more effort into their learning (Cisero, 2006). Cisero (2006) also highlights a tremendous gain from reflective writing in that the deep connection that students make with the content has the ability to change the way a student thinks and learns.

Cohen-Sayag & Fischl's (2012) study of pre-service teachers agrees with the gains that can be made from engaging in critical reflection and its impact on practice. Their study, however, indicated that it was only the students that received intense critique and feedback from their teacher that were able to reach the highest levels of self-reflection necessary to improve their skills and abilities (Cohen-Sayag & Fischl, 2012). The study demonstrated that simply assigning or engaging in reflective writing is not enough to improve outcomes. It must be fostered, developed, and nurtured by the teacher so that students get better at the process of self-reflection, which is vital to improving their skills.

In a study of college students enrolled in a first-year seminar course Everett (2013) noted the positive results of reflective journal writing on participating students. Everett indicated that the teacher did not respond to every journal entry and yet the program was still successful, which is contrary to the findings of Cohen-Sayag & Fischl (2012), who saw more gains from the students that received regular feedback about their writing. The goals of the program were simply to increase engagement and retention (Everett, 2013). The success of this program did not depend on feedback by the instructor but rather was contingent upon the importance the instructor placed on journal writing, the intended purpose of the writing, and the obligation on the part of the teacher reading the journals to take them seriously and make changes (Everett,

2013). When an assignment, or program in this case, has the meaning and purpose indicated above it will be successful (Carr, 2013).

Clapp's (2013) study of reflective writing in a high school biology course was based on the idea that reflection is a way to increase knowledge and academic outcomes, which has been demonstrated by Cisero (2006), Cohen-Sayag & Fischl (2012), and Everett (2013). Clapp goes on to note that while there was only a slight gain (two percentage points) between the performance of the control group and the experimental group on two exams, there were other positive outcomes. Over half of the 24 students indicated that the reflective writing made them feel more confident about the material within the unit (Clapp, 2013). This indicates that reflective writing has the potential to positively impact students' understanding and self-efficacy (Clapp, 2013).

McLaren & Webber (2009) had far more dramatic results. After the institution of the Writing across the Curriculum (WAC) program in an Ecology course the instructor stated that he had a 100% pass rate for the first time ever in the 20 years he had been teaching that course. This was a 32% increase in pass rate from the previous year (McLaren & Webber, 2009, p. 368). It is important to note that reflective writing (in this case exit slips & dialogue journaling) were a piece of the WAC program and not its foundation. Even still, the evidence exists that writing had a tremendous positive impact on student performance (McLaren & Webber, 2009).

According to a study done by Wills & Clerkin (2009), the business students involved in that study engaged in reflective writing throughout a semester and as a result outpaced an international field of competitors during the global simulation games they participated in. Wills & Clerkin believe that reflection is a key reason why their students consistently outperform other university students during the competition. They add that it is specifically the analysis and

reflection on decisions and procedures that has led to the success. Reflective writing is most effective when it stimulates higher-level thinking connecting background knowledge to real-world situations (Wills & Clerkin, 2009). Attributing one more positive outcome to this type of writing, Wills & Clerkin reveal the glowing student evaluations at the end of the course as an indicator of its success.

There are limitations to these positive results. Cisero's (2006) study demonstrated the most gain for average performing students; reflective writing had little noticeable effect on high and low performing students. The high achievers will still perform well and the struggling students will still require attention whether the class engages in reflective writing or not (Cisero, 2006).

McLaren & Webber (2009) point out that it is possible that the dramatic increase in performance (the 100% pass rate) could be attributed to differences in the student population between semesters. The previous year saw a larger class size, a change in the teacher, and was a particularly poor performing group. These variables were not addressed in the implementation of the study.

It is also important to point out that in the study done by Cohen-Sayag & Fischl (2012) the better performing group may have simply been growing as writers and practitioners because the instructor gave far more useful and nurturing feedback than simply acknowledging receipt of the journal, which was the case for the underperforming group.

Conclusion

When looking at the Writing across the Curriculum (WAC) study by McLaren & Webber (2009) it can be deduced that any writing will have a positive impact. Reflection was only a part of the program. The writing assignments included in the WAC program, however, all had a clear

purpose and meaning (McLaren & Webber, 2009). They were not simply a tiresome paper that students failed to complete consistently and had little positive impact in the end. This concern is highlighted by Costley (2013) who discourages the use of homework as busy work, which can backfire preventing students from developing important skills as they have little time to do anything else but homework. Cisero (2006) adds that when students are simply reading their textbooks they aren't actively learning and that this can be resolved through reflective writing. As a result this researcher has determined that a simple summary paper is not active learning and is merely a tedious, disengaging assignment without meaning or purpose.

It is the goal of this study to improve multiple-choice scores through reflective writing. Cisero (2006) cautions that reflective writing is better served for answering essay questions; this fact may be a serious limitation of the proposed study. However, information gathered from Cisero (2006) indicates that a possible solution could be to make sure that the journal assignment directly reflects the knowledge assessed on the quizzes.

The literature did not specify any outcomes related to multiple-choice quizzes. This suggests that the proposed study may fill a gap in the research. The literature does, however, demonstrate that reflective writing increases engagement, thinking, comprehension, connection to previous knowledge, and confidence in students (Cisero, 2006; Cohen-Sayag & Fischl, 2012; Everett, 2013; Clapp, 2013; McLaren & Webber, 2009; & Wills & Clerkin, 2009). It is the determination of this researcher that an investigation into the effect of changing a summary paper over the reading assignment into a reflection paper responding to a teacher provided prompt will result in higher assignment completion rates and an improvement in multiple-choice quiz scores.

Methodology

Students in CT 150 Intro to Live Sound Technology are asked to write a one-page summary over each week's reading assignment. This assignment had an average completion rate of 75% during fall semester 2014. Accumulated data over the course of the semester has shown that it is not the same group of students that fail to complete the assignment. While there is a strong contingent of students that complete the summary paper every week the same cannot be said for the non-completers. This indicates a possible issue with the assignment and not with the students because one week a student will complete the summary and the next week they might not.

The weekly writing assignments were designed to prepare students for the weekly multiple-choice quizzes, which get more difficult as the semester goes on. If students are failing to complete the writing assignment on a regular basis their chances of receiving high scores on the multiple-choices quizzes are reduced dramatically.

This has forced the researcher to question the meaning and purpose of the weekly summary paper. In order for the students to properly prepare for the weekly assessment quiz they need to complete the written homework assignment. If the students are tasked with a more engaging, thought-provoking writing prompt, will the overall completion rate of that assignment go up resulting in improved scores on multiple-choice quizzes?

This study demonstrates the result of having students engage in high-order reflective and its impact on completion rates of writing assignments and multiple-choice quiz scores.

Research Design

In the past students in CT 150 have been asked to write a one-page summary paper over the weekly reading assignment prior to an in-class discussion of that reading assignment. The idea being that the students would enter the classroom discussion having reviewed the reading

and to some extent would have digested the content by writing a short summary. Engagement and participation in the class discussion hinges on those two variables, as does performance on the weekly multiple-choice quizzes. After a thorough review of the literature it has been determined that reflective writing is far more engaging than the current summary paper and will have an impact on assignment completion rates and quiz scores when the writing prompt is focused on the content to be assessed.

Students were asked to either respond to, or reflect on, a specific topic or idea from the reading or to the overall reading itself (see Appendix C). On certain weeks students were given the choice to either agree or disagree with a specific statement made during the reading and/or class discussion while providing evidence to support their opinion. In all cases students were encouraged to relate the content or topic from the writing prompt to their academic major. This is important because not every student in CT 150 Intro to Live Sound Technology is actually majoring in live sound but the topics still have applicability to their chosen field.

The prompts created for the reflection papers are listed in Appendix C. The prompts are based on the following topics covered during the intervention: electricity, signal sources, equalization, and signal processors.

It is important to note that this study did not create a new assignment nor did it ask the students to complete an assignment that was not originally part of the course. It simply altered the focus of the current writing assignment in order to make it more engaging and meaningful for students. In the course syllabus and on the student eportal the name of the assignment changed from Summary Paper to Reflection Paper during the intervention period. It still had the same weight and same number of assignments.

There was one other, perhaps, significant change in that the reflection paper was due after each in-class discussion rather than prior to. This allowed the instructor to provide some valuable background knowledge to help connect the discussion to the reading and vice versa. The process each week was read-discuss-reflect rather than read-summarize-discuss.

Data Collection Plan

During fall semester 2014 the mean quiz score for this course was 73%. The mean score on the first quiz was 93%. A drop of twenty percentage points in mean score over the course of the semester is considerable. The mean completion rate for the summary paper was 75% with the highest completion percentage (91%) on the first summary paper.

Over the four-week intervention period quantitative data was collected on the percentage of students that completed the reflective writing assignment and on mean quiz scores. This data was compared to the data from the previous semester and baseline data from spring semester 2015 up until the intervention was complete. Each week there was a reflective writing prompt concerning the weekly reading assignment followed by a multiple-choice quiz. There were a total of eight writing assignments, four were summary papers pre-intervention and four were reflection papers post-intervention. Students submitted the writing assignments electronically to the class eportal. The mean completion percentage was calculated by viewing the number of submitted assignments both before and after the intervention.

There were also nine quizzes, five before the intervention and the last four during the intervention. Each week grades were entered into the student eportal and from that information mean scores were calculated.

Data was also collected using two student surveys, one pre-intervention and the other post-intervention.

Survey 1 (Appendix A) describes students' opinions of and reactions to the summary papers and Survey 2 (Appendix B) describes students' opinions of, and reactions to the reflection papers. The surveys measured the effects that the two writing assignments had on the following areas:

1. Enhancement of writing skills.
2. Understanding and comprehension of reading assignment.
3. Value in preparing for quizzes.
4. Value in preparing for in-class discussion (Survey 1 only); helpful in digesting and processing in-class discussion (Survey 2 only).
5. Confidence level prior to quizzes.
6. Writing assignment being engaging and worthwhile.
7. Preferred the Reflection Paper more than the Summary Paper (Survey 2 Only)

Qualitative data was also collected in the form of open-ended statements provided by the students at the end of each survey. This allowed for more descriptive information and shed some light on students' specific opinions regarding both types of writing assignments as the students offered information that could not be obtained through the survey questions alone.

Observations were also made of the students during the in-class discussion. The teacher observed the engagement and participation of the students and the class as a whole. These observations were recorded as notes. The notes were reviewed to highlight any general trends in the observations of the students.

Table 1 is the triangulation matrix that demonstrates the relationship between the data collection methods and the research questions.

Table 1.

Triangulation Matrix

Research Question	Data Source		
	1	2	3
1. Writing Assignment Completion Rate?	Baseline data from class eportal (Fall 2014)	Pre-intervention data from class eportal	Post-intervention data from class eportal
2. Engagement?	Survey 1	Teacher Observations	Survey 2
3. Quiz Scores?	Baseline data from class eportal (Fall 2014)	Pre-intervention data from class eportal	Post-intervention data from class eportal

Comparing baseline data from the previous semester to the performance of the current students up to the start of the intervention provided a solid basis of information before the intervention was implemented. The post-intervention data demonstrated the impact on completion rates and quiz scores and there were two pools of data to compare to which raised the validity of the data.

As far as transferability, this study simply provided data that may appeal to another researcher or teacher looking at the benefits of reflective writing. This study was only completed in one classroom of thirty-six students, which is not a large enough population to make assumptions about generalizing the data to other classrooms, students, and schools.

Data Analysis

All data from student grades and performance collected and presented in this study was confidential. In most cases the data was calculated as a mean score to show the progress of the class as a whole but it was, in some cases, useful to compare scores of individual students to demonstrate any correlation. In those cases a number rather than a name was assigned to each student to protect their confidentiality.

The data from the surveys was anonymous. Students were asked to refrain from signing their names to the survey forms ensuring their anonymity.

It was also useful to show the progression of quiz scores throughout the intervention rather than simply displaying that as a cumulative average score at the end of the intervention. The intervention started with quiz six, which was then compared via a line graph to quiz seven, eight, and nine, and also to pre-intervention data in order to show the progression of scores (see Figure 5).

The data for the writing assignments was represented as cumulative scores for ease of comparison but it was also useful to show that in a line graph comparing the full semester's writing assignments visually just like the quiz scores (see also Figure 5).

Both sets of data are displayed together in Figure 5 for comparison. The data shows the percentage of students that completed the reflective writing assignment and the resultant quiz scores.

During the in-class discussions the teacher was observing the students and the class as a whole in order to gather data on their participation and engagement. These observations revealed the general level of students that asked questions, took notes, and/or made constructive comments during the class discussions. These notes were compiled, organized, and described in the study.

Survey questions/statements will be scored using Likert scales showing whether the students strongly agree (SA), agree (A), are undecided (U), disagree (D), or strongly disagree (SD). Point values will be assigned to each descriptor: SA = 2, A = 1, U = 0, D = -1, SD = -2. This researcher felt that undecided (U) should have a score of 0 (zero) so that positive (+) and negative (-) totals could be seen for each survey question. The data from the survey was entered

into a table showing all six questions (seven on Survey 2) and the total scores for each. The data was also compiled to show each question and the total responses for each descriptor (i.e.

Question 1 – SA 15, A 9, U 5, D 4, SD 3).

Sample Selection

In the spring semester 2015 CT 150 Intro to Live Sound Technology course there were thirty-six students between the ages of 18 and 21. Thirty-three were male and three were female. Thirty-five of the students were audio engineering majors and there was one video production major. Thirty-four of the students were second semester freshmen and two of the students were seniors graduating in May 2015.

This group of students was selected because CT 150 is a foundational course that is heavy in theory and is the only lecture course that this researcher teaches. Younger NESCom students, like the students in this course, tend to struggle with traditional lectures making it a perfect candidate for this study, as the researcher desired to make a positive difference in students' academic achievement.

Results

The results section below summarizes the data collected through the research process. Parts of the data collected were the completion rates of weekly summary papers (pre-intervention) and the completion rates of weekly reflection papers (post-intervention). Those two completion rates were compared to see if there was an improvement in the percentage of students that completed the writing assignments. Those completion rates were then compared to the weekly quiz scores to see if there was a connection between completion of the writing assignments and student performance on weekly quizzes.

The researcher also questioned the engagement level of the summary paper and provided the students with Survey 1 (Appendix A) before the intervention began. Survey 1 was used to collect information about students' opinions of the summary paper before they knew that the writing assignment would be changed to a reflection paper. This ensured that students would respond to the survey questions simply based on their opinions of the summary paper without being influenced by the study. If students knew that the summary paper was changing it is possible that it could have altered their responses to the survey questions.

Findings

Baseline data exists from fall semester 2014 for the same course. The existing data from that semester consists of completion rates for eight summary papers and scores for eight multiple choice quizzes.

Table 2 shows student grades (out of ten) and completion rates for the summary papers for CT 150 for fall semester 2014. Grades for summary papers two and seven have been removed as those papers were replaced with group projects.

Each student's name has been omitted and replaced by a random number (1-23) in column one. Columns 2-9 show the grades that each student received on that assignment. Column ten shows each student's mean score for the semester and column eleven shows each student's overall completion rate for the eight summary papers. Whenever there is a zero it indicates that the student did not turn in a paper and received a zero for a grade.

The bottom two rows show the mean score for the class for each summary paper and the completion rate for the class for each summary paper. The bottom right cell shows the class's average completion rate of the summary papers for the semester.

Table 2.

Fall Semester 2014 Summary Paper Grades & Completion Rates

Student	S.P. #1	S.P. #3	S.P. #4	S.P. #5	S.P. #6	S.P. #8	S.P. #9	S.P. #10	Mean	Comp %
1	10	0	10	8	0	0	9	10	5.88	62.50
2	10	10	10	10	7	0	9	10	8.25	87.50
3	10	0	10	10	10	10	10	9	8.63	87.50
4	10	10	0	0	0	10	7	0	4.63	50.00
5	10	10	10	10	10	10	10	10	10.0	100.00
6	10	10	10	10	8	10	10	10	9.75	100.00
7	10	0	10	0	10	10	10	10	7.50	75.00
8	10	9	10	0	10	0	0	0	4.88	50.00
9	10	10	10	10	10	10	10	10	10.0	100.00
10	10	10	10	10	10	0	7	10	8.38	87.50
11	10	0	10	10	0	0	0	10	5.00	50.00
12	10	0	0	0	0	10	0	10	3.75	37.50
13	10	10	10	10	10	10	10	0	8.75	87.50
14	10	10	10	10	10	10	10	10	10.0	100.00
15	10	10	0	0	10	10	0	0	5.00	50.00
16	0	10	7	9	0	0	10	0	4.50	50.00
17	10	10	10	10	10	10	10	8	9.75	100.00
18	10	10	10	10	10	10	9	10	9.88	100.00
19	7	0	0	9	0	0	0	8	3.00	37.50
20	10	10	10	10	10	10	10	10	10.0	100.00
21	5	10	10	10	10	10	10	10	9.38	100.00
22	0	10	10	6	0	10	10	7	6.63	75.00
23	10	8	0	10	0	0	0	0	3.50	37.50
Mean	8.78	7.26	7.70	7.48	6.30	6.52	7.00	7.04	7.26	
Comp %	91.30	73.91	78.26	78.26	65.22	65.22	73.91	73.91		75.00

Table 3 shows student quiz scores for CT 150 for fall semester 2014. Data for quiz number eight has been removed as that week's lesson and subsequent quiz was skipped due to an adjustment to the course schedule. In this table student names have been removed and replaced by a number. Column 2-8 display the quiz scores for each student and column ten shows the mean quiz score overall for each student. The three bottom rows display the mean, median, and mode for the class for each quiz.

Table 3.

Fall Semester 2014 Quiz Scores

Student	Quiz #1	Quiz #2	Quiz #3	Quiz #4	Quiz #5	Quiz #6	Quiz #7	Quiz #9	Mean
1	75	74	0	40	60	100	0	93	55.25
2	75	90	80	70	90	70	89	65	78.63
3	100	74	50	85	90	93	81	50	77.88
4	100	70	80	70	40	100	61	61	72.75
5	100	64	90	90	90	85	89	100	88.50
6	100	74	50	80	60	93	95	93	80.63
7	90	90	70	95	70	62	0	33	63.75
8	100	60	70	90	70	70	80	52	74.00
9	100	60	90	100	80	93	0	75	74.75
10	100	70	50	70	60	62	27	40	59.88
11	90	74	40	90	80	77	91	45	73.38
12	100	70	50	80	80	77	55	50	70.25
13	100	74	80	95	80	100	87	82	87.25
14	100	80	50	100	70	77	100	87	83.00
15	100	64	60	100	100	100	82	0	75.75
16	100	80	30	80	30	65	36	58	59.88
17	85	84	80	110	100	100	95	0	81.75
18	80	50	80	110	70	93	89	75	80.88
19	80	90	50	75	80	42	53	55	65.63
20	85	74	50	80	60	77	69	86	72.63
21	100	50	70	90	100	85	81	68	80.50
22	85	60	30	100	80	62	73	35	65.63
23	100	70	40	60	50	0	49	49	52.25
Mean	93.26	71.57	58.26	85.22	73.48	77.52	64.43	58.78	72.82
Median	100	74	50	90	80	77	80	58	
Mode	100	74	50	90	80	100	0	93	

Similar data collected from fall semester 2014 can be compared to spring semester 2015.

For spring semester 2015 baseline data (pre-intervention) was collected from four summary papers and four quizzes. Table 4 shows student grades (out of ten) and completion rates for summary papers 1-4 for CT 150 for spring semester 2015. Data for summary paper two is not included because that paper was replaced with a group project. This table is set up in an almost identical manner to Table 2 except that there are 36 students instead of 23 and only four

summary papers instead of eight. You can still refer to the last column for completion rates and the bottom two rows for mean score and completion rates for each summary paper. Whenever there is a zero it indicates that the student did not turn in a paper and received a zero for a grade. The average completion rate for the class is displayed in the bottom right cell.

Table 4.

Spring Semester 2015 Summary Papers 1, 3, 4 & 5 Grades & Completion Rates

Student	S.P. #1	S.P. #3	S.P. #4	S.P. #5	Mean	Comp %
1	10	10	7	0	6.75	75
2	0	0	0	0	0.00	0
3	0	10	0	8	4.50	50
4	10	10	10	10	10.00	100
5	10	10	10	10	10.00	100
6	10	0	0	0	2.50	25
7	10	10	10	10	10.00	100
8	0	10	8	10	7.00	75
9	8	8	7	10	8.25	100
10	10	8	5	10	8.25	100
11	5	0	7	0	3.00	50
12	10	10	10	10	10.00	100
13	0	10	10	10	7.50	75
14	8	10	8	8	8.50	100
15	10	10	10	10	10.00	100
16	10	10	10	0	7.50	75
17	7	10	8	10	8.75	100
18	8	9	0	10	6.75	75
19	10	10	10	10	10.00	100
20	0	10	7	0	4.25	50
21	5	0	0	0	1.25	25
22	10	9	6	10	8.75	100
23	9	7	8	10	8.50	100
24	10	10	10	10	10.00	100
25	0	0	0	0	0.00	0
26	10	10	9	10	9.75	100
27	5	7	5	9	6.50	100
28	9	0	0	9	4.50	50
29	10	9	8	10	9.25	100

30	10	10	10	10	10.00	100
31	8	0	5	10	5.75	75
32	8	10	9	9	9.00	100
33	10	10	10	10	10.00	100
34	10	10	10	10	10.00	100
35	10	10	10	10	10.00	100
36	8	10	10	10	9.50	100
Mean	7.44	7.69	6.86	7.58	7.40	
Comp %	83.33	80.56	80.56	77.78		80.56

Table 5 displays data for the first five quizzes for spring semester 2015. This table is almost identical to Table 3 except that there are 36 students instead of 23 and five quizzes instead of eight. The mean score for each student is displayed in the right-hand column and the bottom three rows show the mean, median and mode for each quiz for the whole class.

Table 5.

Spring Semester 2015 Scores for Quizzes 1-5

Student	Quiz #1	Quiz #2	Quiz #3	Quiz #4	Quiz #5	Mean
1	90	80	40	70	89	73.80
2	65	24	70	30	67	51.20
3	85	70	70	100	100	85.00
4	90	100	70	110	100	94.00
5	100	80	70	110	78	87.60
6	90	80	60	90	56	75.20
7	100	80	70	90	78	83.60
8	100	24	30	85	89	65.60
9	80	80	70	90	78	79.60
10	90	40	20	90	67	61.40
11	85	74	30	60	45	58.80
12	100	70	70	90	89	83.80
13	90	64	80	105	89	85.60
14	90	50	60	85	56	68.20
15	100	70	60	90	100	84.00
16	80	64	40	65	89	67.60
17	50	60	20	80	78	57.60
18	90	44	60	70	89	70.60

19	85	60	60	100	89	78.80
20	75	74	40	65	0	50.80
21	70	54	40	20	78	52.40
22	100	60	70	90	78	79.60
23	75	80	40	46	0	48.20
24	65	80	60	100	78	76.60
25	50	64	30	10	34	37.60
26	100	90	80	100	78	89.60
27	80	50	30	70	78	61.60
28	100	74	60	60	89	76.60
29	85	60	60	80	89	74.80
30	85	90	40	90	89	78.80
31	80	80	50	60	67	67.40
32	90	64	40	50	56	60.00
33	90	70	40	110	78	77.60
34	100	60	30	70	23	56.60
35	85	100	70	95	89	87.80
36	45	64	50	40	78	55.40
Mean	84.31	67.44	52.22	76.83	72.44	70.65
Median	87.50	70.00	60.00	85.00	78.00	
Mode	90.00	80.00	70.00	90.00	89.00	

Table 6 displays the results of Survey 1 (Appendix A). Three students were absent the day Survey 1 was handed out, which is why there are 33 responses instead of 36. The number of students that responded according to each descriptor is displayed in this table.

Table 6.

Survey 1 Results

Question	Score					Total Responses
	SA	A	U	D	SD	
1	2	9	11	9	2	33
2	4	17	7	5		33
3	1	15	7	8	2	33
4	2	18	8	3	2	33
5	1	10	6	11	5	33
6	2	11	13	7		33
Totals	12	80	52	43	11	198

Table 6 shows the number of students that chose each of the five rating scales from Strongly Agree (SA) to Strongly Disagree (SD) for each survey question. No values have been assigned to the data in this table. This table simply displays the raw scores for each survey question along each row. The bottom row displays the total number of each response for all six questions.

Table 7 displays the results of Survey 1 with values assigned to each descriptor. The values assigned to SA, A, U, D, & SD were 2, 1, 0, -1, & -2 respectively. Those values were chosen to show whether the class had a net positive or net negative response to the survey questions and to the survey collectively. Those net totals could then be interpreted quantitatively.

Table 7.

Survey 1 Rated Scores

Question	SA(V2)	A(V1)	Score			Rated Scores
			U(V0)	D(V-1)	SD(V-2)	
1	4	9	0	-9	-4	0
2	8	17	0	-5	0	20
3	2	15	0	-8	-4	5
4	4	18	0	-3	-4	15
5	2	10	0	-11	-10	-9
6	4	11	0	-7	0	8
Totals	24	80	0	-43	-22	39

Table 7 column seven shows the positive and/or negative reactions to each question with the chosen values factored in. For instance, question two had net positive reaction (+20) compared to net negative reaction to question five (-9). This data has been displayed graphically in figure 1. The bottom right cell of Table 7 shows the overall reaction to the questions included in Survey 1 (Appendix A) after assigning the chosen values to each descriptor.

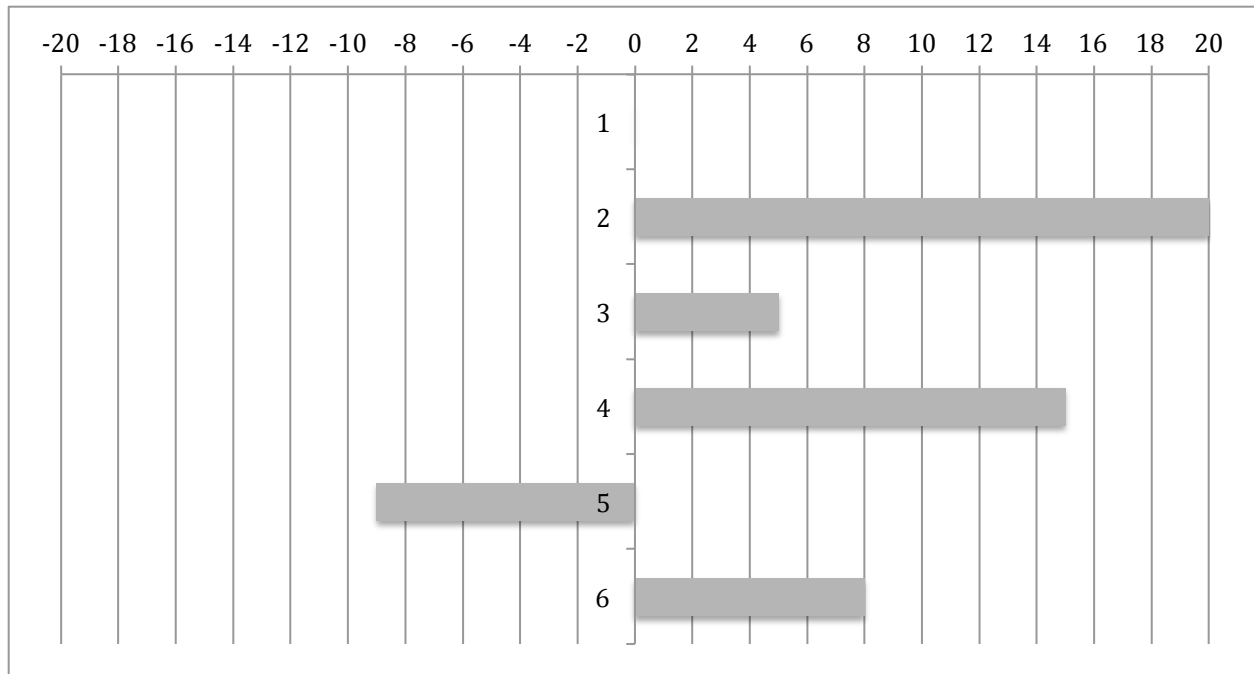


Figure 1. Rated Reaction to Summary Paper Survey Questions

Students also added general comments about the summary papers at the bottom of Survey 1 (Appendix A). The student comments have been organized into five categories:

1. The summary papers were helpful. (4 students)
2. Students don't believe that writing helps them learn. (5 students)
3. There are other factors that inhibit their writing. (2 students)
4. Other comments (cannot easily be categorized). (4 students)
5. No comment was made. (18 students)

Table 8 displays the post-intervention data from the first four reflection papers. Column one shows the number (1-36) assigned to each student rather than their name. Student grades for each paper are included in columns 2-5 with each student's mean score in column six and their completion rates in the last column. The bottom two rows show the mean score for the class and the average completion rate for the class for each paper. Whenever there is a zero it indicates

that the student did not turn in a paper and received a zero for a grade. The bottom right cell shows the average completion rate for the class for the four papers.

Table 8.

Spring Semester 2015 Reflection Papers 1-4 Scores & Completion Rates

Student	R.P. #1	R.P. #2	R.P. #3	R.P. #4	Mean	Comp %
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	10	10	10	10	10	100
5	10	10	10	10	10	100
6	9	10	0	0	4.75	50
7	10	10	8	10	9.5	100
8	0	10	10	10	7.5	75
9	10	10	10	10	10	100
10	10	10	10	10	10	100
11	10	10	8	0	7	75
12	10	9	0	10	7.25	75
13	10	10	10	10	10	100
14	10	10	10	10	10	100
15	10	10	10	10	10	100
16	9	0	10	0	4.75	50
17	10	10	0	0	5	50
18	10	10	10	10	10	100
19	10	10	10	10	10	100
20	0	0	10	10	5	50
21	10	5	10	10	8.75	100
22	10	10	10	10	10	100
23	10	10	10	10	10	100
24	10	10	10	10	10	100
25	0	0	0	0	0	0
26	7	10	10	9	9	100
27	10	10	10	10	10	100
28	10	10	10	0	7.5	75
29	10	10	10	10	10	100
30	10	10	10	10	10	100
31	10	10	10	0	7.5	75
32	10	10	10	10	10	100
33	10	10	10	10	10	100

34	0	0	0	0	0	0
35	10	10	10	10	10	100
36	10	10	10	0	7.5	75
Mean	7.92	7.89	7.67	6.64	7.53	
Comp %	80.56	80.56	77.78	66.67		76.39

Table 9 displays the quiz scores and their averages for quizzes six, seven, eight, and nine. A number (1-36) has replaced each student's name. Columns 2-5 show each student's quiz score with their mean scores in the last column. The bottom three rows show the mean, median and mode for the class for each quiz.

Table 9.

Spring Semester 2015 Scores for Quizzes 6, 7, 8, & 9

Student	Quiz #6	Quiz #7	Quiz #8	Quiz #9	Mean
1	85	100	92	84	90.25
2	85	0	20	60	41.25
3	70	0	60	44	43.50
4	100	100	90	97	96.75
5	100	100	99	94	98.25
6	80	99	90	40	77.25
7	85	90	67	64	76.50
8	77	91	65	70	75.75
9	100	62	90	87	84.75
10	77	97	75	75	81.00
11	93	93	39	0	56.25
12	93	100	0	77	67.50
13	100	95	100	84	94.75
14	85	92	87	74	84.50
15	93	100	95	100	97.00
16	62	94	80	74	77.50
17	70	80	62	62	68.50
18	93	100	74	65	83.00
19	77	90	85	60	78.00
20	85	66	75	40	66.50
21	77	90	64	62	73.25
22	93	81	75	75	81.00

23	100	88	75	93	89.00
24	80	63	70	44	64.25
25	39	59	47	34	44.75
26	93	82	97	80	88.00
27	93	98	90	88	92.25
28	72	92	74	52	72.50
29	93	82	72	62	77.25
30	70	99	92	82	85.75
31	65	80	75	50	67.50
32	77	100	65	57	74.75
33	95	86	77	0	64.50
34	0	27	40	47	28.50
35	70	88	54	82	73.50
36	65	89	75	84	78.25
Mean	80.33	82.03	71.86	65.08	74.83
Median	85	90	75	67.5	
Mode	93	100	75	84	

Table 10 displays the results of Survey 2 (Appendix B). Two students were absent the day Survey 2 was handed out, which is why there are 34 responses instead of 36. The number of students that responded according to each descriptor is displayed in this table.

Table 10.

Survey 2 Results

Question	Score					Total Responses
	SA	A	U	D	SD	
1	6	12	11	5		34
2	7	20	5	2		34
3	5	17	8	4		34
4	8	19	6	1		34
5	3	10	12	9		34
6	19	10	2	2	1	34
7	9	13	10	1	1	34
Totals	57	101	54	24	2	238

Table 10 shows the number of students that chose each of the five rating scales from Strongly Agree (SA) to Strongly Disagree (SD) for each survey question. No values have been assigned to the data in this table. This table simply displays the raw scores for each survey question along each row. The bottom row displays the total number of each response for all seven questions.

Table 11 displays the results of Survey 2 (Appendix B) with values assigned to each descriptor. The values assigned to SA, A, U, D, & SD were 2, 1, 0, -1, & -2 respectively. Those values were chosen to show whether the class had a net positive or net negative response to the survey questions and to the survey collectively. Those net totals could then be interpreted quantitatively.

Table 11.

Survey 2 Rated Scores

Question	SA(V2)	A(V1)	Score			Rated Scores
			U(V0)	D(V-1)	SD(V-2)	
1	12	12	0	-5	0	19
2	14	20	0	-2	0	32
3	10	17	0	-4	0	23
4	16	19	0	-1	0	34
5	6	10	0	-9	0	7
6	38	10	0	-2	-2	44
7	18	13	0	-1	-2	28
Totals	114	101	0	-24	-4	187

Table 11 column 7 shows the positive and/or negative reactions to each question with the chosen values factored in. For instance, question two had the net positive reaction of +32 compared to the net positive reaction to question five of +7. This data has been displayed graphically in Figure 2. The bottom right cell of Table 11 shows the overall reaction to the

questions included in Survey 2 (Appendix B) after assigning the chosen values to each descriptor.

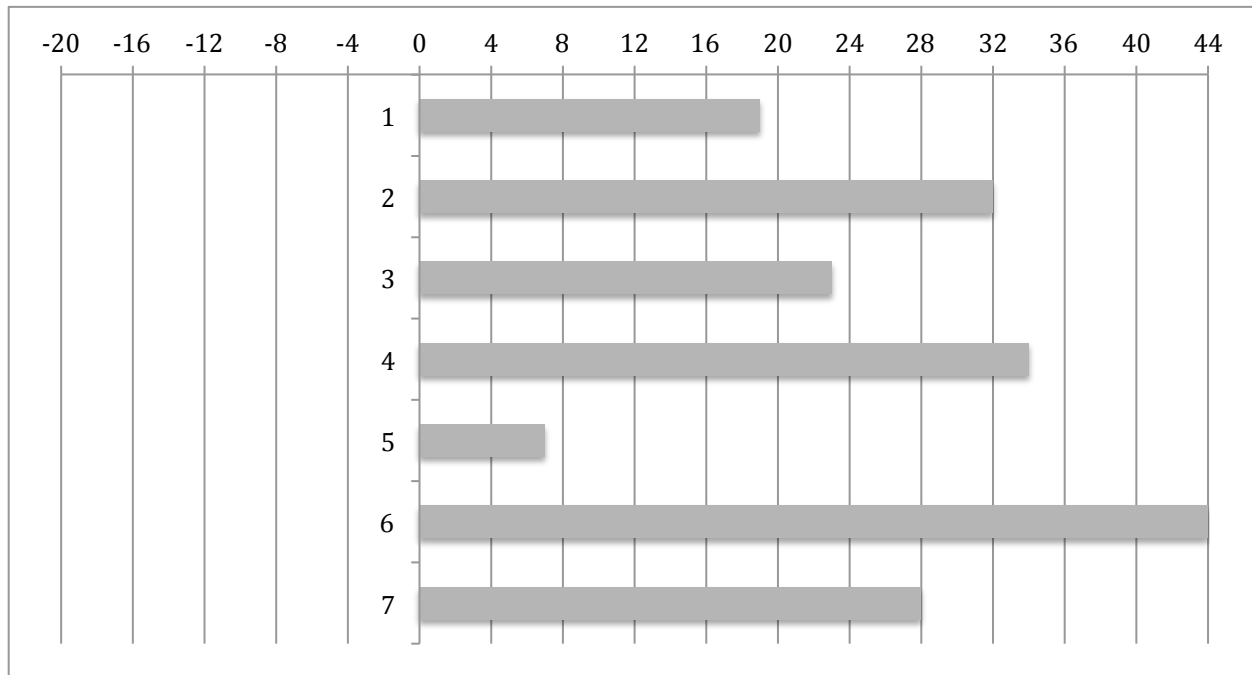


Figure 2. Rated Reaction to Reflection Paper Survey Questions

Students also added general comments about the summary papers at the bottom of Survey 2 (Appendix B). The student comments have been organized into six categories:

1. The reflection papers were better. (5 students)
2. The summary papers were better. (1 student)
3. Students don't believe that writing helps them learn. (2 students)
4. Negative aspects of reflection papers. (3 students)
5. Other comments (cannot easily be categorized). (3 students)
6. No comment was made. (20 students)

The researcher also made observations of student participation and engagement during the four-week intervention and data collection period but no baseline observations were made

pre-intervention nor are there any recorded observations from fall semester 2014. The researcher took notes on the general atmosphere of the classroom, student attitude and interest level of students during class discussions during the spring semester 2015 intervention period.

During week one the researcher handed out Survey 1 (Appendix A) and noted a high level of interest and excitement amongst the students. Students were asked to fill out the survey after which the researcher explained the parameters of the study. The researcher noted that students seemed to be asking more questions and were generally more enthusiastic than normal.

During week two the students were placed into small groups assigned to complete a series of Ohm's Law problems. This lesson also began with another instructor discussing with the students possible career options for live sound technology graduates. During the slideshow for that presentation there was a high level of interest from the students as they asked about possible jobs and where some of the graduates were working.

The students were also informed that their first reflection paper would be over the two-week electricity unit that they were finishing up that day. The researcher stated that observations made during the small group work indicated that that was the most engaged the class had ever been all semester. The small group activity replaced the normal class discussion for that week.

At the start of class on week three of the intervention the students were notified of the expected writing at the very beginning of class. The researcher wanted students to have the option of asking questions about the topic and to focus the discussion around what was expected from their writing assignment. The researcher observed that students asked far more questions than normal about the writing assignment while adding that the number of questions related to the in-class discussion topic did not increase.

During week four, which was the last week of data collection, the researcher handed out a hard copy of the reflective writing prompt at the start of class. The researcher noted that this week's lecture topic sparked a high level of interest and discussion. The researcher added that that was most likely a result of the topic and not directly related to the writing assignment, which according to the researcher was acceptable because the information from the discussion would be needed in order to write the reflection paper.

Discussion

Table 2 column two shows the first summary paper had a completion percentage of 91.3% ending with a mean completion rate of 75% for the semester in column eleven. The average rate for the class for the semester is 16.3% lower than it was for the first summary paper. This is a significant drop. Looking closer at Table 2 shows that there was a substantial dip on papers six & eight down to 65.22%. While the completion rate recovered slightly on the last two summary papers only papers one, four and five show a completion rate above the average of 75%. Figure 3 displays this graphically.

Table 2 also shows that the low completion rates are not necessarily linked to certain students. When looking at the zeros on Table 2, which indicate that a student did not complete a particular summary paper, it can be determined that on almost every assignment a different group of students failed to turn it in. Also students that missed two or three or even four assignments in row might turn in a summary paper on any given week.

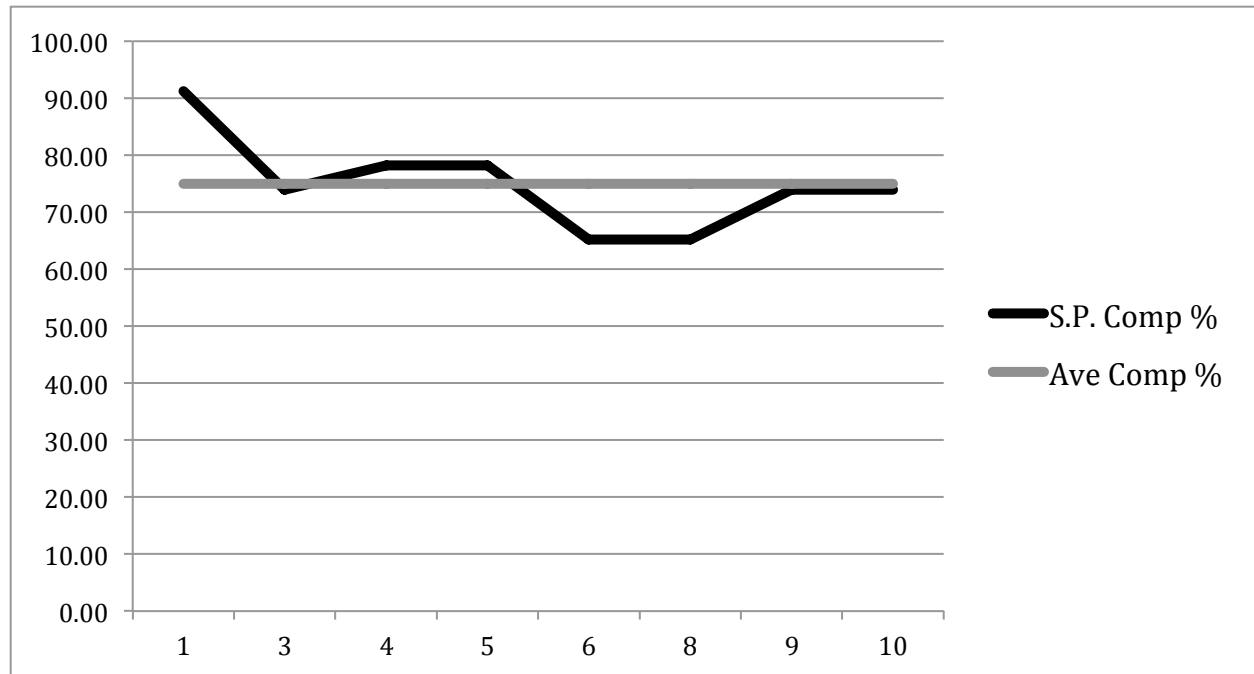


Figure 3. Fall Semester 2014 Summary Paper Completion Rates

Table 3 column two shows a mean quiz score of 93.26% for quiz one ending with a mean quiz score of 72.82% for the semester in column ten. Table 3 demonstrates the highest mean score over the course of the semester occurring on quiz one. After that the mean quiz score drops 20.44% to an average of 72.82%. The last quiz for fall semester 2014 had a mean score of 58.78%, which was only .52% higher than the lowest mean score on quiz three (58.26%). Besides quiz 3, which was mostly likely a result of a group project that replaced the summary paper for that week, a downward trend in mean quiz score can clearly be seen in Table 3. Except for the slight recovery in completion rates in Table 2 both Tables 2 and 3 have a noticeable downturn in student performance over the course of the semester.

Table 4 presents data for spring semester 2015 and displays a similar downward trend in completion rate. Summary paper one peaked at 83.33% and column five shows a completion rate of 77.78% for summary paper four. One major difference between Table 2 and Table 4, and

therefore the fall semester vs. the spring semester, is that completion rates in Table 4 can very clearly be linked to particular students. During spring semester 2015 there were two students that did not turn in a single summary paper and two other students that only did one paper each.

Figure 4 outlines the completion rate graphically.

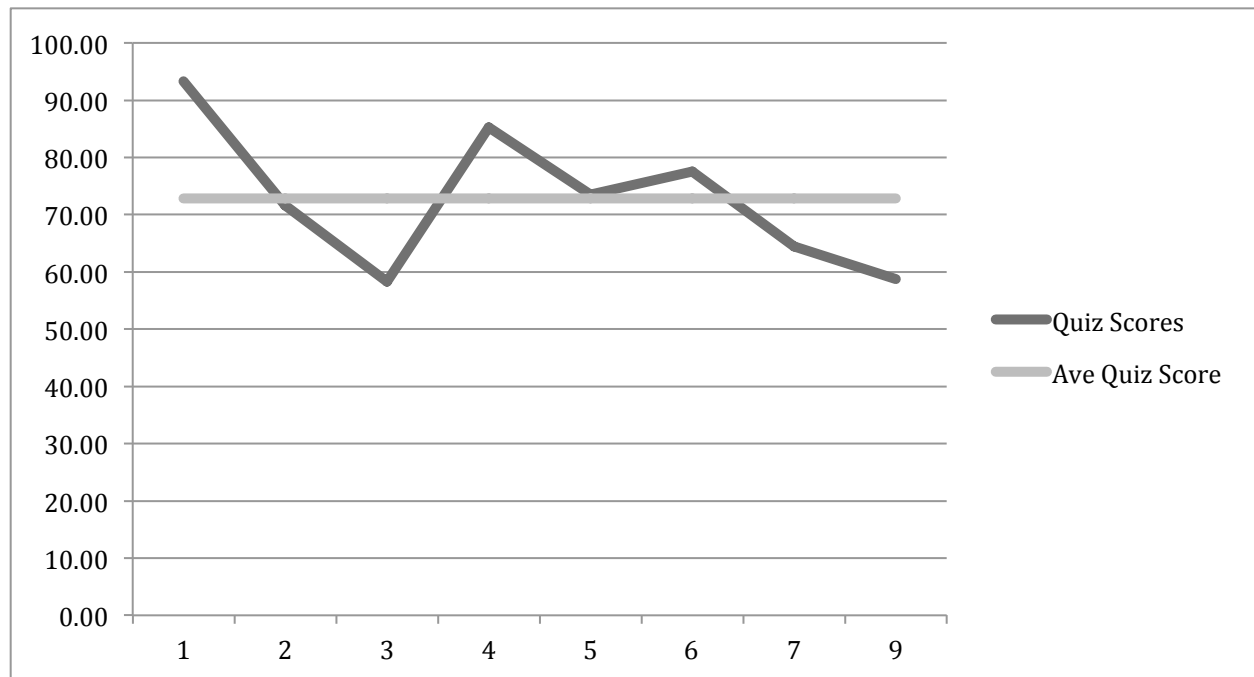


Figure 4. Fall Semester 2014 Mean Quiz Scores

Table 5 column two shows a mean score of 84.31% for quiz one and column six shows a mean score of 72.44% for quiz five. That difference demonstrates another significant downturn in student performance with a substantial dip at quiz three. The students did a group project that week, which may partially explain the dramatic drop in the mean quiz score. This drop in score on quiz three during the week of the group project corresponds to the same drop for the same quiz during the same project week seen in Table 3 for fall semester 2014. This means that there was no writing assignment that week and the students were busy working on their group projects. Both factors seem to have seriously affected that particular quiz score in both semesters.

Completion rates and quiz scores for spring semester 2015 can be seen graphically in Figure 5. The averages for both quiz scores and completion rates indicate that while the completion rate decreased for the intervention, which was caused by the significant drop on reflection paper four, mean quiz scores rose by nearly half a letter grade.

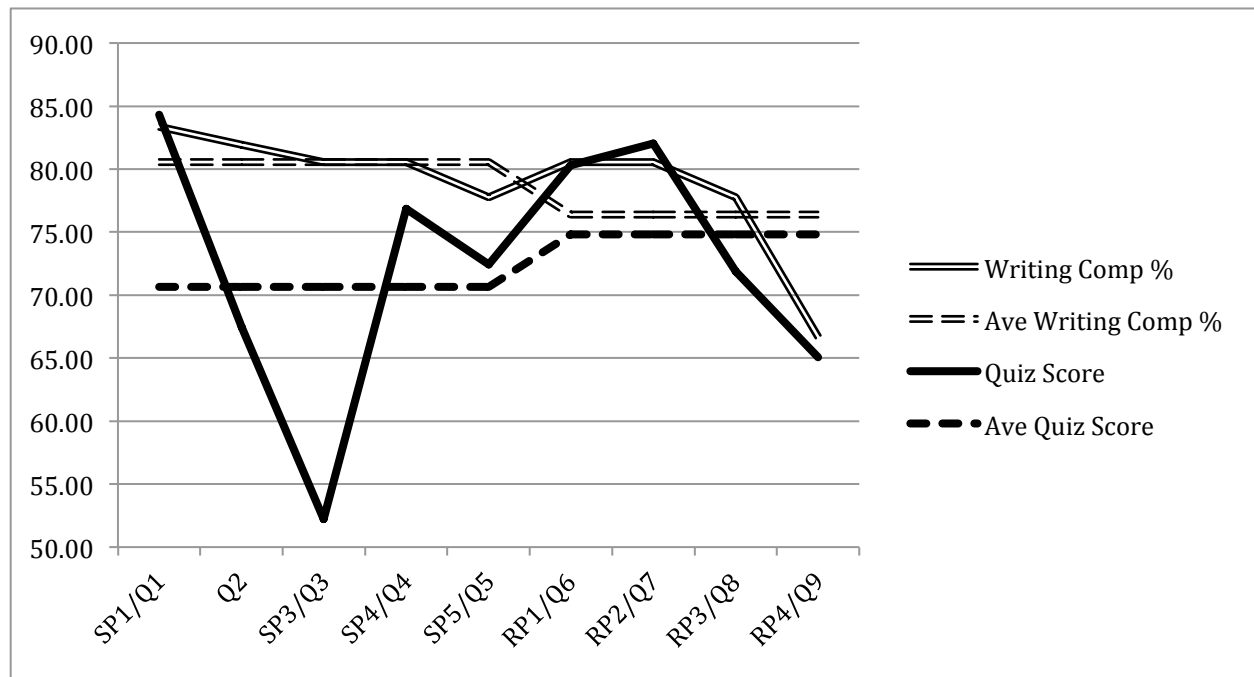


Figure 5. Spring Semester 2015 Completion

Table 6 shows the results of Survey 1 (Appendix A) in their raw form. The class was evenly split on question one. The number of students that agreed was the same number that disagreed that the summary paper enhanced their writing skills. Question two had twenty-one students that agreed or strongly agreed that the summary papers helped them better understand and comprehend the material from the reading assignment with only five students disagreeing and with no students strongly disagreeing. Question three had 15 students that agreed that the summary papers were useful in preparing for the quizzes but seven students disagreed and two strongly disagreed.

Question four had the highest number of students (18) agree with any survey question in this case that the summary papers were useful in preparing for the in class discussion. Question five demonstrates the need to analyze the data in a different way (see Table 7). It looks like the class was fairly split as to whether or not the summary papers had a positive effect on student confidence prior to the quizzes, but upon closer inspection you can see that 16 students disagreed with that statement and 5 out of those 16 strongly disagreed. Results for question six indicate that 13 of the students were undecided, the highest number for that category, as to whether or not the summary papers were engaging and worthwhile.

While it is possible to surmise, based on the data from Table 6, that the overall survey responses to the summary paper statements were positive, the data shows something else when organized in a different manner; this is displayed in Table 7.

Table 7 displays the results of Survey 1 in a different form. Table 7 has applied values to the rating scale. Displayed as a graph in Figure 1 you can clearly see the positive reactions to the survey and summary papers. Except for question five, which unmistakably shows a negative response. Figure 1 shows that while the students believe that the summary papers help with understanding and comprehension (question two) and in preparing for the quizzes (question three) they do not believe that they improve their confidence prior to taking the quizzes (question five). That is counter to what one might deduce from simply looking at the data on questions two & three from Table 6.

An analysis of the student comments reveals some interesting things. For the students that indicated that the summary papers were helpful (category one), two of the comments describe what the researcher's primary goal would be for all students that engage in writing,

which is thinking deeper about the material. However, it has been revealed by the literature and from the student survey comments that not all students can do that without guidance.

- “All in all the summary papers are a good way to next level think about the content.”
- “I like the summary papers; it forces you to read & by writing it reinforces the material.”

Some students do not believe that writing helps them learn (category two) or believe that there were other elements of the course that served them better than the summary papers did.

- “I tend to learn better from being shown things and being verbally told about them. It is harder for me to learn from reading or writing.”
- “I was unaware that there were study guides for the quizzes. I feel the study guides are most effective for preparation.”

It was also noted that for some students there are other factors that inhibit their writing (category three). From the comments it appears that part of this issue could be addressed with a more focused prompt rather than an open summary.

- “What makes the papers hard to write is the fact that I don’t always understand what I’m reading; I find the discussions and study guides more useful.”
- “...it was hard to determine what was the information I should retain.”

There were also other comments that could not be easily categorized (category four). In one case it seemed that allowing the students the freedom to write either an outline, a bulleted list, or a narrative caused confusion for those that required a more structured format.

- “I haven’t quite figured out format requirements. Originally stated it could be bulleted as well as paragraphs. What is your preference?”

The last comment, which has little to do with the summary paper, reveals the need for a more focused prompt so that students do not feel so overwhelmed with content.

- “Try and mix class up a little so it doesn’t feel like so much info to cram in.”

The summary paper comments reveal that the writing assignment needs to be connected to the reading, to the class discussion, and offer direction and focus, while preparing the students for the in-class quiz. Changing the writing assignment to a reflection paper will address those needs.

Table 8 shows the first of the data from the intervention. Column two of Table 8 shows that the completion rate for the first reflection paper was 80.56% this is an increase of 2.78% over summary paper five, which was the previous writing assignment and had a completion rate of 77.78%. That 2.78% means that one extra student completed reflection paper one over summary paper five. Comparing Table 8 to Table 2 shows that reflection paper one replaced what would have been summary paper six during fall semester 2014. Fall semester 2014 had a completion rate for summary paper six of 65.22%. The difference in the completion rates across semesters between those two writing assignments was 15.34%. That clearly shows that more students completed the first reflection paper than summary paper six during the same point in the previous semester. Looking at the next reflection paper shows 80.56% on Table 8 to 65.22% on Table 2, or 15.34% higher. The mean rates for the two tables compare at 76.39% to 75%. That shows a 1.39% increase in mean completion rate between Table 8 and Table 2 (refer to Figure 6), which is not statistically significant.

Comparing table 8 to Table 4 (spring semester 2015 reflection papers to spring semester 2015 summary papers) shows a decrease in the completion rate of the reflection papers. There was a slight 2.78% improvement in completion rate between summary paper five and reflection

paper one, but the mean completion rate for the summary papers was 80.56% (Table 4), while the mean completion rate for the four reflection papers was 76.39% (Table 8). This low number was caused by a significant drop in the completion rate of reflection paper four, which sunk to 66.67% pulling down the class average drastically (refer to Figure 5). Only two-thirds of the class completed the last reflection paper negating what might have been a mean completion rate for the reflection papers of near 80%. This would not have been an improvement over the summary papers but at least would have been on par with them.

Across the eight writing assignments the completion percentage varies 16.66% with the largest single dip of 11.11% occurring between reflection paper three and four (as shown in Figure 5).

Figure 6 shows the average writing assignment completion rates and mean quiz scores for both semesters.

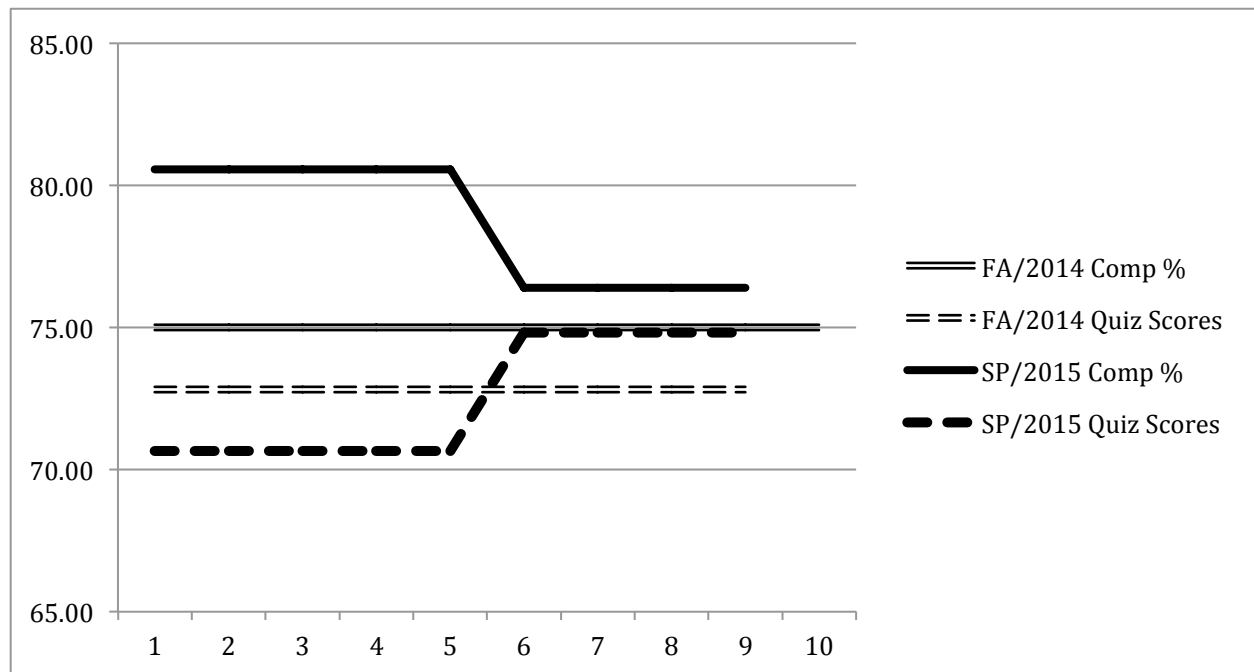


Figure 6. Comparing Fall 2014 to Spring 2015 Average Completion Rate and Mean Quiz Scores

Table 9 shows a mean score of 80.33% for quiz six. This is an increase of 7.89% from the mean of 72.44% for the previous quiz (quiz five) from Table 5. Comparing Table 9 to fall semester 2014 (Table 3) shows an increase 2.81% over the same quiz from the previous semester, which had a mean score of 77.52%. When comparing the mean scores for the last four quizzes of spring semester 2015 to the last three quizzes (six, seven, & nine; quiz eight was skipped) of fall semester 2014 there is a significant difference. Those last three quizzes (six, seven, & nine) happen to coincide with the writing of the reflection papers. The mean scores on those four quizzes for spring semester 2015 are 74.83% and 66.91% for fall semester 2014. That is a substantial 7.92% improvement that translates into nearly a letter grade higher.

Table 9 shows that quiz seven had a mean score of 82.03%, the highest score during the intervention, which is only 2.28% lower than quiz one from Table 5, which had the highest mean score of the semester. It has been typical in this course for the highest score to occur on the first quiz.

The variation in completion rate and quiz score across both semesters is shown in Figure 7. The difference between completion rates at the end of each semester can clearly be seen. Across semesters the reflection papers seem to have prevented the downturn in completion rates and quiz scores from occurring earlier. The last quiz and reflection paper has an enormous impact reducing both averages.

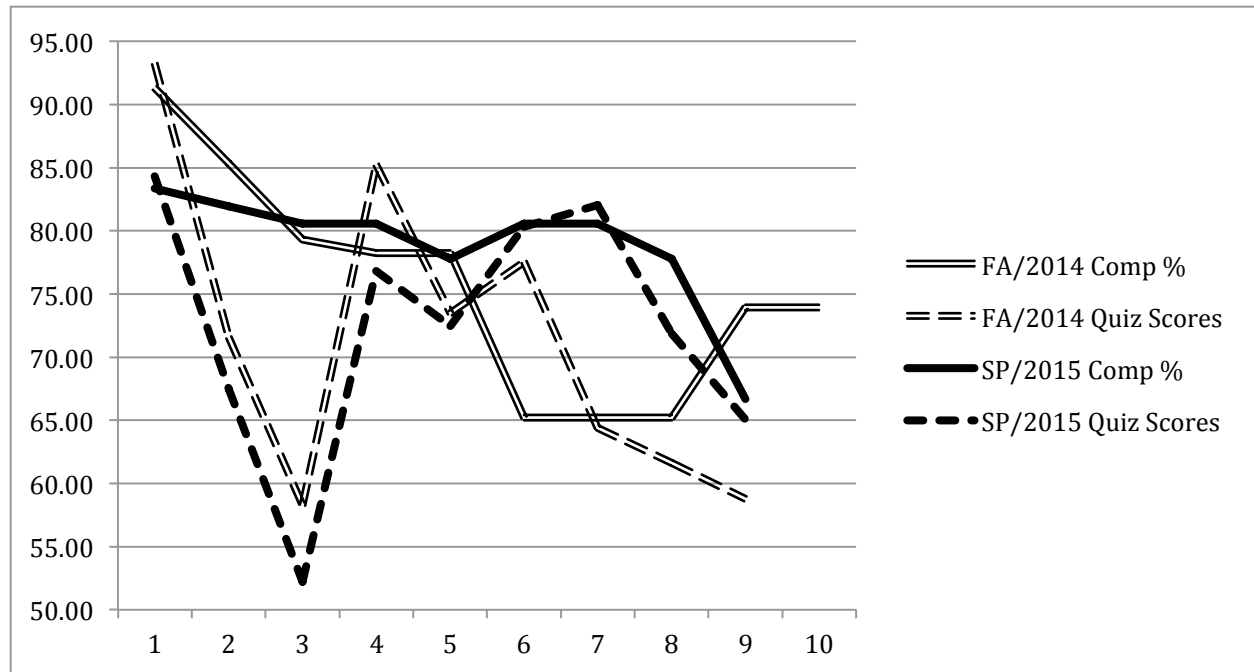


Figure 7. Comparing Fall 2014 to Spring 2015 Quiz Scores & Completion Rates

Table 10 displays the results of Survey 2 (Appendix B) in their raw form. There were 158 responses that either agreed or strongly agreed with the survey statement regarding the reflection papers. Ignoring the 22 positive responses for question seven, which did not exist on Survey 1 (Appendix A), Survey 2 (Appendix B) shows 136 total responses for agree or disagree. That is a total of 44 more responses than Survey 1 (92 students agreed or disagreed). Each of the questions on Survey 2 had a far more favorable response than on Survey 1. This indicates that students liked the reflection papers more so than the summary papers. Comparing Table 6 to Table 10 also reveals that there were 52 undecided responses on Survey 1 and 54 undecided responses on Survey 2. Survey 2 also had an additional question not found on Survey 1 that garnered ten of the undecided responses. The shift in favorable responses on Survey 2 cannot be attributed to students shifting from disapproving (disagree or strongly disagree) to undecided

because only two more students (a total of 54) indicated they were undecided on Survey 2 compared to Survey 1.

Question seven also asked if students preferred the reflection paper more so than the summary paper. Only one student disagreed, while one other strongly disagreed. This confirms the positive scores shown in Table 10 demonstrating that students preferred the reflection papers much more than the summary papers.

Table 11 shows the rated scores when values are applied to the scales in Table 10, which displays the results of Survey 2 in a different form. Table 11 column seven shows the net positive reaction to each survey statement after applying those values. This is displayed graphically in Figure 2. Comparing Figure 2 to Figure 1 (rated results of Survey 1) you can see the change in question five from -9 to +7. All other statements (except for question seven on Survey 2, which did not exist on Survey 1) have a positive response and show an increase in that positive response when comparing Figure 1 and Figure 2.

Student comments for Survey 2 (Appendix B) are outlined below. One of the goals of this study was to research whether or not the reflection paper was a more meaningful engaging assignment that would appeal to students. A few students indicated that they preferred the reflection papers to the summary papers (category one) and a few sighted reasons similar to the researcher's goal of engagement.

- “I like these reflections because it translates into the audio industry that there is no ‘right’ way to do things. The reflections are more open answered than a summary.”
- “I like it. The way class is done now is easier to understand.”

One student did comment that the summary papers worked better for them (category 2).

- “I feel the summary papers better helped me grasp the concepts from the reading.”

A few students still feel that writing is not the best way to learn (category 3), though one student admits that they had not done that many of the writing assignments.

- “I think class and the study guides prepare me more for the quizzes.”
- “I think the study guides help me the most. I often forget the reflection papers were assigned.”

Some students noted some negative aspects of the reflection papers or offered advice on how to improve them (category 4). One student notes that the sharing of their opinion is a little outside their comfort zone.

- “Maybe provide more of a guided prompt rather than such an open ended question.”
- “I find it hard to produce a quality paper based on my opinion of that week’s lecture.”
- “...I think more in-depth questions are needed to test our knowledge.”

The last comments had nothing to do with reflection papers (category 5) but were supportive of the class and the instructor.

- “...you are the best professor on the [school’s] staff.”
- “This was one of my favorite classes. You’re a good teacher.”

Challenge is a key to engagement (McClenney et al., 2012). Some of the student comments infer that more challenge is necessary, or that the reflection papers challenge them to offer their opinion. Some of the comments demonstrate the need for the researcher to clarify that the textbook and reading are only one source of information for the course, with the discussion just as, if not more, important. The summary papers only covered the reading assignment and

did not allow the students to connect the reading to the class discussion, which is something the reflection papers are able to do.

The teacher observations made during the intervention do indicate more participation from the students. It should be noted that the researcher believes that this may stem simply from the change of pace within the classroom rather than being directly related to the reflection papers. During week one there was discussion and interest in the study, though it had nothing to do with the intervention. Students also seemed excited about the survey. Perhaps, though students did not indicate it directly, they may have liked the idea that the researcher was asking for their opinion through the surveys. It is possible that the study itself was impacting its own results. Had students not been informed of the study the findings may have been different.

The second week saw more student engagement as a result of small group work on Ohm's Law. This was different from the typical class format as it was the only class devoted to a small group activity. Another instructor was also present that day giving students a slideshow on possible careers in live sound. The interest level from the students was most likely the result of the changes to the class format that day rather than the reflection papers, as the first paper had not yet been assigned.

During week three the students were informed of the writing prompt at the beginning of the discussion. This dramatically increased the number of questions from students, however, they were related to the reflection prompt and clarification of what was required for the students to write.

During the last week of the intervention and data collection students were given a hardcopy of the reflection prompt at the start of class. While the researcher noted that interest in

the prompt was high it was related to the topic and not the fact that students would be writing about it.

Overall student interest and engagement during the intervention was higher than it had been previously. The researcher acknowledges that that is not necessarily a direct result of the reflection paper intervention. One goal of the summary paper was to prepare students for the in-class discussion. An unforeseen, yet positive, result of the intervention was that the discussions prepared students for the reflection papers. In order for students to write a thorough reflection they had to participate in the class discussion even if only to ask for clarification on the prompt.

The researcher also noted that while there seemed to be more questions asked throughout the intervention, they came mostly from the same group of students.

Limitations

This study was not designed to evaluate the impact of students' increasing familiarity with the instructor's expectations and teaching style as the semester progressed and its inherent effect on improving student performance. Those factors may have contributed to gains in individual student quiz scores and the class average.

Another limitation to this study is that reflection paper one was the sixth writing assignment of the semester and may have seen a slight uptick in completion rate simply because of the change of pace. It was a new and, for some students, possibly exciting writing assignment.

There was a drop in completion rate on reflection paper four at the end of the intervention period, which could be attributed to end-of-year boredom or perhaps student excitement and interest in writing the reflection papers had waned by then. Neither limitation was accounted or adjusted for in this study.

The reflection papers were also assigned after the students had completed the reading and participated in the in-class discussion. During the discussion the instructor was able to provide the students with more reasoning, meaning, and application of the content than could be gained by the student simply reading the text on their own. Most of the sample population have very little background knowledge with the content and were therefore only able to write the summaries based solely off their experience with the reading assignment. This study did not investigate ways to improve the weekly summary papers in that regard nor did it consider moving the summary paper due dates to after the class discussion. It is the opinion of this researcher, though, that the previous limitation adds validity to the reflection papers and provides more evidence for why they are a better assignment.

The spring semester 2015 CT 150 course was also larger than the previous semester, thirty-six students to twenty-three students. Those thirteen-students represent a 50% increase in sample size, which may have had an impact on the results of the study.

It is also possible that any increase in quiz scores may have been the result of some students not understanding that study guides for quizzes were located on the class eportal until quiz three of the semester. While that was well before the intervention occurred, which to some degree lessens the impact of this limitation, the researcher does allow that it might have taken those students a few weeks to adapt to the study guides and could have possibly led to an improvement in their performance on quizzes during the intervention. It is important to note, though, that looking at Figure 7 demonstrates an increase in quiz scores during the intervention period that is not present during fall semester 2014 even though both semesters had study guides for the quizzes. This indicates that the reflection papers still had a positive impact.

The last limitation is that the researcher found it difficult to quantify classroom observations. A second researcher may be needed in future studies to record more detailed observations rather than qualitative and often subjective notes.

Summary and Further Research

It does not look as though completion rates improved dramatically over the first four reflection papers. However, when compared to the same point in the previous semester the change to the reflection papers may have prevented a significant drop in completion rates from occurring sooner than it did for the writing assignment (see Figure 7). The last four summary papers for fall semester 2014 had a completion rate of 69.56%. During the same time period in spring semester 2015, which corresponds to the intervention, completion rates were 6.83% higher. Further study is needed to see if a full semester of reflection papers experiences the same downturn in completion rates that have been observed with the summary papers.

Quiz scores on the other hand went up by nearly a letter grade. Quiz six, which was the first quiz after the reflection paper intervention began, increased by 7.89% over quiz five, which is a significant improvement. When looking at the same quiz for fall 2014 there was only a slight improvement of 2.81% for the intervention period. While not statistically significant overall there are valuable improvements in both completion rates and quiz scores that deter any outright disproof of the research hypothesis. More research is needed to compare a full semester of reflective writing to the current baseline data. This researcher believes that reflective writing had enough of a positive impact to warrant future use in this and other courses.

Action Plan

This study provides some interesting insights into future action and teaching practice. The reflection papers had a positive impact. Even though completion rates went down for spring

semester 2015, which can be attributed to a poor performance on reflection paper four (see Figure 5), quiz scores went up by almost half a letter grade. It will require more investigation to find out why the last writing assignment plummeted so far down in completion rate. Despite the completion rate falling off for the last assignment, this study has revealed that the effects of the reflection papers (even just in terms of the increase in quiz scores) were positive enough to continue using them in the future.

The results of the Survey 2 (Appendix B) indicate that students preferred the reflection papers over the summary papers and there was an overwhelming positive increase to the student responses from Survey 1 to Survey 2 that warrant the requirement of the reflection papers in the future.

The classroom observations also demonstrated that student engagement and interest were noticeably higher when the class format was changed. The small group activity on Ohm's Law during week two of the intervention, according to the researcher, saw the highest levels of engagement from students over the course of the semester. This has forced the researcher to consider ways to expand the small group activities across the semester, both in this course and in other courses. There also may be ways to tie the reflection papers to the group activities, either through small group research or small group discussions.

New England School of Communications has been looking at ways to increase the amount of writing required by its students. The results of this study have been overwhelmingly positive and indicate that writing can be a strong component of a technology course, even one where the students are typically hands-on learners. This study has already been shared with a number of the faculty and the results will continue to be discussed as this research continues into the future.

Conclusion

The results of this study appear to be contradictory. The completion rate of the reflection papers during the intervention was lower than it was for the summary papers during the pre-intervention period; however quiz scores during the intervention rose by nearly half a letter grade. That's a substantial improvement. When comparing the completion rate across both semesters the intervention period during spring semester 2015 was 15% higher than it was for fall semester 2014. Without the existing data from fall semester 2014 the results of this study could have been interpreted differently.

This highlights the importance of data collection and analysis for this and other teacher researchers. Based on the current literature, reflective writing has a demonstrated history of positive outcomes. The research presented in this study shows that those outcomes can now include improved quiz scores, higher levels of student engagement, and based off previous semester data, improvements in writing assignment completion rate. There is even evidence (shown in Figure 7) that the change to reflective writing prevented a significant drop in completion rate across semesters. Future research will be needed to uncover whether a full semester of reflective writing experiences the same end of semester decline that the summary papers saw during fall semester 2014.

This study has shown that a change of pace within the classroom has positive benefits. Simply altering or modifying the classroom format could avert a decline in engagement or assignment completion. If future research determines that a full semester of reflection papers sees the same drop in completion rate, changing the design of or even just the writing prompt itself could be a potential solution.

This action research project signifies that teachers can promote effective change in their classrooms. Teachers do this by collecting and analyzing data that exists as a normal part of their courses and by acting on what that data suggests. Studies like this require that researchers reflect on their own practice. This is not unlike the reflective writing that was required of students in this study. Reflection on the part of the students led to enhanced engagement, increased assignment completion and improved quiz scores. Reflective writing was beneficial for the students in this study and will continue to be for other students in the future.

References

- Carr, N. S. (2013). Increasing the effectiveness of homework for all learners in the inclusive classroom. *School Community Journal*, 23(1), 169-182. Retrieved from <http://files.eric.ed.gov/fulltext/EJ1004337.pdf>.
- Cisero, C. A. (2006). Does reflective journal writing improve course performance? *College Teaching*, 54(2), 231-236. Retrieved from <http://web.a.ebscohost.com.une.idm.oclc.org/ehost/pdfviewer/pdfviewer?sid=67a76883-cf1e-41de-bde59ed4f94b8d05%40sessionmgr4001&vid=6&hid=4212>.
- Clapp, L. (2013, June). Influences of reflective writing in high school biology. In McCoy, L. P., Editor. *Studies in Teaching 2013 Research Digest*. Action Research Projects Presented at Annual Research Forum, Wakefield University, Winston-Salem, NC. Retrieved from <http://files.eric.ed.gov/fulltext/ED543854.pdf#>.
- Cohen-Sayag, E., & Fischl, D. (2012). Reflective writing in pre-service teachers' teaching: What does it promote? *Australian Journal of Teacher Education*, 37(10). Retrieved from <http://files.eric.ed.gov/fulltext/EJ995258.pdf>.
- Costley, K. C. (2013). Does homework really improve achievement? Retrieved from <http://files.eric.ed.gov/fulltext/ED542436.pdf>.
- Epstein, J. L., & Van Voorhis, F. L. (2001). More than minutes: Teachers' roles in designing homework. *Educational Psychologist*, 36(3), 181-193. Retrieved from http://www.hartdistrict.org/sierra/staffdev/files/More%20than%20minutes_Teachers%20Roles%20in%20Designing%20Homework_Epstein.pdf.
- Errey, R., & Wood, G. (2011). Lessons from a student engagement pilot study: Benefits for students and academics. *Australian Universities' Review*, 53(1), 21-34. Retrieved from

- <http://files.eric.ed.gov/fulltext/EJ926446.pdf>.
- Everett, M. C. (2013). Reflective journal writing and the first-year experience. *International Journal of Teaching and Learning in Higher Education*, 25(2), 213-222. Retrieved from <http://files.eric.ed.gov/fulltext/EJ1016545.pdf>.
- McLaren, I. M., & Webber, D. (2009). Writing right: Enhancing student engagement and performance in an ecology course. *International Journal of Environmental and Science Education*, 4(4), 365-380. Retrieved from <http://files.eric.ed.gov/fulltext/EJ884403.pdf>.
- McClenney, K., Marti, C. N., Adkins, C., & Community College Survey of Student Engagement (CCSSE). (2012). Student engagement and student outcomes: Key findings from "CCSSE" validation research. *Community College Survey of Student Engagement*. Retrieved from <http://files.eric.ed.gov/fulltext/ED529076.pdf>.
- Ryan, M. (2011). Improving reflective writing in higher education: A social semiotic perspective. *Teaching in Higher Education*, 16(1), 99-111. Retrieved from <http://www-tandfonline-com.une.idm.oclc.org/doi/pdf/10.1080/13562517.2010.507311>.
- Wills, K. V., & Clerkin, T. A. (2009). Incorporating reflective practice into team simulation projects for improved learning outcomes. *Business Communication Quarterly*, 72(2), 221-227. Retrieved from <http://dx.doi.org.une.idm.oclc.org/10.1177/1080569909334559>.
- Wood, B. (2012, June). Reflective journal writing and student engagement. In McCoy, L. P., Editor. *Studies in Teaching 2012 Research Digest*. Action Research Projects Presented at Annual Research Forum, Wakefield University, Winston-Salem, NC. Retrieved from <http://college.wfu.edu/education/wp-content/uploads/proceedings12.pdf#>.

Appendix A: Survey 1

For the following questions please indicate whether you:

strongly agree (SA), agree (A), are undecided (U), disagree (D), or strongly disagree (SD).

1. I believe that the weekly summary papers are a valuable assignment that helps to enhance my writing skills.

SA A U D SD

2. I believe that the weekly summary papers help me to better understand and comprehend the reading assignments.

SA A U D SD

3. I believe the weekly summary papers have been helpful in preparing for the weekly quizzes.

SA A U D SD

4. I believe the weekly summary papers have been helpful in preparing me for the in-class discussions.

SA A U D SD

5. I feel confident when taking the weekly quizzes because of the summary papers.

SA A U D SD

6. Overall, I believe the summary paper is an engaging, worthwhile assignment.

SA A U D SD

Please add any other comments regarding the summary papers below:

Appendix B: Survey 2

For the following questions please indicate whether you:

strongly agree (SA), agree (A), are undecided (U), disagree (D), or strongly disagree (SD).

1. I believe that the weekly reflection papers are a valuable assignment that helps to enhance my writing skills.

SA A U D SD

2. I believe that the weekly reflection papers help me to better understand and comprehend the reading assignments.

SA A U D SD

3. I believe the weekly reflection papers have been helpful in preparing for the weekly quizzes.

SA A U D SD

4. I believe the weekly reflection papers have been helpful in digesting & processing the in-class discussion.

SA A U D SD

5. I feel confident when taking the weekly quizzes because of the reflection papers.

SA A U D S

6. Overall, I believe the reflection paper is an engaging, worthwhile assignment.

SA A U D SD

7. I enjoyed the writing the Reflection Papers more than I did the Summary Papers.

SA A U D SD

Please add any other comments regarding the reflection papers below:

Appendix C: Reflection Paper Prompts

Reflection Paper 1: Electricity

1. Describe one interesting thing that you learned about Electricity over the past two weeks and explain why you think it's either interesting or important.
2. Electricity can be a confusing and certainly abstract concept to grasp. What have you struggled with the most regarding this subject and why?

Reflection Paper 2: Signal Sources

1. Using information, data, specifications, and/or your own knowledge and experience with/from the twelve microphones on slide 5...describe how you would mic up a band with those twelve mics?
2. You must back up each mic choice with an explanation. Do not simply write, "For the Kick Drum I'd use an SM57." You must explain why using info, data, specs, and/or experience/knowledge. This includes data about frequency response, polar pattern, dynamic range, etc. You must include something you have learned about each mic to explain each mic choice you make.
3. This will require you to research each mic to find out their specifications and/or articles from professional engineers offering their opinions.
4. There are twelve mics...your reflection paper should have at least twelve channels...

Reflection Paper 3: Equalization (EQ)

1. Do you agree or disagree with any of the statements I made or tips/advice I offered regarding EQ? Why or why not?

2. Has that discussion about EQ expanded your thinking about what EQ really is or given you alternate ways to utilize this very important tool? Will the EQ discussion this week change your workflow? Why or why not?

3. Would this EQ discussion have changed any of your microphone choices from last week's reflection paper? Why or why not?

Reflection Paper 4: Signal Processing

1. The similarities and differences between Compressors and Limiters are typically easier to grasp, though not always the case. They both do essentially the same thing, and that is to reduce Dynamic Range. What is the main difference between the two devices? Has this difference always been clear to you?

2. Expanders and Gates are confused or misunderstood more often by students. Both devices have similar goals but one is more dramatic than the other. How do they differ?

3. In the lecture I noted that in most cases I typically use an Expander and not a Gate. Do you agree with my reasons (refer to the PDF on Canvas if you need to)? Why or why not?

4. Do you now have a better understanding of those 4 amplitude processors? What, if anything, still confuses you?