Listen to this! Utilizing Audio Recordings to Improve Instructor Feedback on Writing in Mathematics

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Abstract: Providing audio files in lieu of written remarks on graded assignments is arguably a more efficient and effective means of student feedback. Its efficiency lies with the rapid pace an instructor can communicate their remarks. Its effectiveness is determined by the students’ ability to process, understand, and improve upon mistakes with their critique. With emerging technologies and software, this audio feedback alternative – albeit breaking away from the traditional paradigm of providing written comments – seems a natural progression to improve student learning. This paper examines experimentation with audio feedback techniques throughout three semesters, and accounts for assessments provided by 106 total students. Although concluding it came at a cost to instructor’s time, the benefits of the audio feedback alternative towards student learning appear substantial.

1. Introduction

On 16 September 2010, as a first year instructor at the United States Military Academy, I sat in the back of a room full of instructors and academy professors listening to the guest speaker, Dr. Annalisa Crannell, give her talk titled “How to Grade 300 Math Essays and Survive to Tell the Tale.” On the verge of collecting and grading my first round of 51 written mathematics projects, I had every motivation to listen closely.

Dr. Crannell’s talk focused on providing large scale graded feedback in mathematics with the intent of fulfilling four criteria. Those criteria, consistent with her published work by the same title as this talk, were that student feedback was: meaningful, equitable to all students, helpful to the students’ writing, and time efficient [1]. Audio feedback was mentioned among other successful techniques employed, and struck me as particularly well suited for the mathematics classroom for reasons I will detail in the next section.

Examples of audio feedback in literature span back as far as 1982 when Olson initiated this technique in support of English courses at his two year college [2]. Using a blank cassette tape submitted along with their papers, he returned audio commentary on their work. Arguably more effective than using the margins and white-space throughout the paper to fit scripted remarks, experimentation and analysis of audio feedback has continued ever since [3] [4] [5] [6].
2. Hypothesis

This experiment hypothesized two principal benefits of delivering audio feedback in support of writing in mathematics. They were gains in student feedback efficiency and effectiveness. To be clear, those terms are defined and elaborated upon below.

Merriam-Webster defines *efficiency* as the “ratio of useful energy delivered by a dynamic system to the energy supplied to it” [7]. In our circumstance, instructors’ efficiency is assessed. Grading can be time consuming, but to what effect? Is the energy invested through ink onto paper delivered as efficiently as verbalizing remarks? Speaking is arguably a more efficient means for an instructor to convey information, requiring less energy to convey an equivalent length message. Less energy means less time, which would be a welcome shift from an often tedious grading process.

Assessing *effectiveness*, we turn our attention to the students. Effectiveness is defined as “producing a decided, decisive, or desired effect” [7]. Supporting classroom objectives, the desired effect is for students to process, understand, and improve upon the mistakes highlighted in their critique. Several implications accompany this definition. For students to process their feedback, they first must give their time to read or listen to it. To understand their mistake they must receive clear guidance highlighting what part of their work is in question and/or their alternate options or solutions. Finally, improvement in the next round of this iterative process ultimately validates development of their skills in writing and mathematics.

3. Motivation

3.1 The human touch.

In his paper on audio feedback, Johanson states it “shifts teacher participation in the writing process from being an impersonal grader to being a writing coach” [4]. Traditionally, the personality behind written feedback is inherently distant. In its most concise and often used technique, feedback with red ink cuts directly to the correction made. Arguably, grading in mathematics is among the most impersonal, considering its mechanical nature of “right versus wrong” often present in mathematical reasoning. For these reasons, a human touch through audio feedback is helpful. The voice of an instructor has several benefits the pen does not.

An audio message puts personality into an instructor’s feedback. Injecting personality does not imply a theatrical performance into the microphone is necessary. Rather, this effect is achieved naturally by a familiar voice speaking directly to its intended audience – that particular student. This personalization of the critique serves a dual purpose to both better captures students’ attention, and enhances the relationship between student and instructor. The latter benefit is illustrated by this common hypothetical; suppose you have a student who is not typically engaged in discussion, both due to a lack of class participation and not engaging the instructor in conversation or for additional help outside of class. Audio recording allows the instructor an
opportunity to speak directly to that student, without an ink-to-paper “mask” to translating thoughts. Although the recording is a one way dialog, it could establish a greater report between them. Opening this line of communication may “break the ice” and should better encourage future discussion between them than the traditional pen-and-ink grading methodology.

3.2 Explaining the why.

Imagine these hypothetical student thoughts towards their written instructor comments: “Insert some parentheses? Simplify this expression? Delete this one? Add some more assumptions to my model? And… voilà; a 100% solution was not far off. I think I can pass this exam.”

Often mathematical corrections point to deficiencies, but rely on their audience to interpret where and why they went wrong. For deeper learning to occur, however, underlying causes and not quick fixes need attention.

Red ink corrections are more likely to lead towards a hypothetical as shown above. Similarly, in his analysis of audio feedback, Still states “Many students see instructor commentary as not constructive but prescriptive directions that must be followed so that their grade, not necessarily their writing, can be improved” [6]. A sequence of markups and comments on paper do not do justice for explaining the why of an instructor’s critique. Why is it significant to move those parentheses, simplify that expression, or explain that assumption. What effects do those actions (or lack thereof) have upon the solution you have communicated?

While this case illustrates the point well, parallel lines of reasoning extend well beyond mathematical expressions in writing. Analogous reasoning can be applied to explaining the why of English critiques in their writing. From the sequence students choose to address their reasoning, the flow from section to section and paragraph to paragraph, tone and professionalism carried throughout the report, etc., critiques reinforced with more of justification via verbal explanation are more likely to produce improved results in the future.

3.3 Do not dilute the message.

John Meier seemingly shouted at the reader in his review of writing in mathematics when he said “You’re not a grammar cop!!” [8]. I appreciate his point – the desired outcome is often not tied to improving students’ English skills, rather their understanding and communication of the mathematics involved. An instructor, however, is often able to catch grammar, formatting, or other relatively minor (through the eyes of a mathematician) English mistakes in a written mathematics product and temptation to cite those corrections looms. Should they be ignored as a sacrifice for more “important” topics? Instructors have confronted a catch-22.

Audio feedback is capable of addressing this dilemma well. I agree when a page is consumed with corrections – everything from spelling and punctuation to formatting – an important point may be overlooked. Red ink does poorly to distinguish between an egregious error and a subtle
one. An instructor’s voice, however, does not. All statements made can be framed in their appropriate context by the instructor’s chosen emphasis. While it would be awkward, time consuming, and cumbersome to frequently write “I am not as concerned with these series of spelling and grammar mistakes, however they are a distraction to the points you are trying to make supporting your mathematical model” on a student’s paper, the opposite is true at the beginning of a voice recorded segment. Needless-to-say, the same holds true when emphasizing a significant error by adding “this is the most costly and critical place in your analysis you went astray, and the mistake carries through the remainder of the report.” Instructors now have the leverage with audio feedback to quickly and appropriately express the relative importance of their critiques to the student without “muddying the water” with excessive remarks on paper.

3.4 Making it worth their time.

“If you read this comment, I’ll buy you a pizza,” …or so the story goes [9]. A math instructor, frustrated with redundant mistakes after iterations of writing in mathematics assignments, decides to conduct an experiment to verify if the remarks they so dutifully write within the body of work submitted for grade are even read. They do so by embedding this phrase among the many other legitimate comments on a random sample of returned assignments, and awaits a response. And, again as the story goes, the instructor never purchased a single pizza.

This myth of a tale is an extreme example of a valid point. How much learning happens after an assignment’s completion? While I believe most all students make it past the mark at the top of the page to read – albeit quickly – the instructor comments throughout the graded assignment, it is difficult to assess how much time and thought are given towards their work “after the fact.” How much does a student process and reflecting upon prior mistakes once the assignment is returned? With grade in hand, their motivation can lack.

At a minimum, we hope students take the time to read comments put before them. At best, they invest additional time, thought, and even re-engaging the material to improve upon their mistakes. Regardless, the point stands that any method capable of re-capturing their attention, both tightening their grasp on the material and improving their communication in writing, is worth exploring. For all those reasons previously listed we hope to capture student’s interest and make them want to listen to what you have to say. From there, learning will improve.

3. Methodology

The first undergraduate mathematics course taken by a typical cadet entering the United States Military Academy played host to all experimental trials in this report. More information regarding data collection is provided later in subsections 3.2 and 3.2.
3.1 Evolution of an audio experiment.

This subsection will detail the software and method used to record and return student assignments with audio feedback. The technique used to deliver the audio recordings endured one significant evolution. During the AY11-1 and AY11-2 semesters, a single audio file was prepared and delivered to students. In AY12-2, multiple audio files of shorter duration were embedded within an Adobe pdf document at relevant locations. These two techniques are described in sequence next.

Single audio feedback recordings made in AY11-1 and AY11-2 used software pre-loaded onto any Microsoft operating system. The Sound Recorder is shown in Fig. 1, and example navigation to it from the Start menu is available in Appendix 1.

![Fig. 1. Microsoft Sound Recorder](image)

The sound recorder enables its user to capture a single audio file. The recorder can be stopped and started multiple times throughout a recording; however, no edits are possible (i.e. no additions, deletions, or truncated segments can be made). When completed, the audio file is e-mailed to its respective student with a brief explanation as outlined in Appendix 2.

Because this technique created a sound file separate from their submitted document, preceding any remark it was necessary to draw the students’ attention to the section of the report being discussed. For example, a remark may begin with “Right now I’m looking at the top of page three and really like how you have…”. Small annotations may also accompany explanations when necessary. For instance, another remark may cite “If you take a look at the circled term in your third equation you will notice…”. This allows the instructor to guide the student’s attention to the particular aspect of their report being discussed.

The method used to record audio transitioned in AY12-2 to a more versatile alternative available through Adobe Acrobat 9. During previous experimentation with the sound recorder, students were required to submit their final product in hard copy form and recordings were made separately. Using Acrobat 9, the instructor could placed recordings directly onto an electronic copy of the students’ project. This option required electronic submission by students, but had significant benefits over the sound recorder, which are explained in the description that follows.

To access the full menu of editing options (required for audio comments), the pdf document must be opened using Adobe Acrobat 9. This is not a default on many computers, and may require the user to right-click their document and select it; this is illustrated in Appendix 3. After opening with Acrobat 9, the user is capable of making several annotations to the pdf document including “sticky notes”, yellow highlights, boxes to highlight, cross-outs, etc. While audio files remain
the focus of this research, this assembly of additional tools is helpful to compliment voice comments. Fig. 2 is an excerpt from Appendix 3, and clearly shows several noteworthy features to mark-up the pdf document.

Fig. 2. Screen captures of a pdf file using Adobe Acrobat 9, and displaying markup tools relevant to inserting instructor feedback into the pdf file.

Audio comments can now be logically co-located next to material relevant to their discussion. An example of this as it appears next to student work is shown in Fig. 3.

Fig. 3. Screen capture of inserted audio comment and “box-in” highlight on the student pdf file.

3.2 MA103 course tie-in.

Experimental results were taken during the first undergraduate mathematics course taken by a West Point cadet, titled MA103: Mathematical Modeling and Introduction to Calculus. All cadets involved were students of mine at the time. The relative class sizes and academic years involved are provided in Table 1.
3.3 Survey Design.

Two questions were used to survey student impressions of this technique. They were issued and collected electronically, and student responses were anonymous. A combination of the USMA Course End Feedback system (AY11-1) and SurveyMonkey (AY12-1, AY12-2) were used to collect responses [10] [11].

The first question is a Likert scale assessment of relative helpfulness of the audio feedback technique in comparison to written feedback. The phrasing of this question is identical in all surveys collected, and shown in Fig. 4.

A subsequent question was asked in both AY12-1 and AY12-2 surveys providing an open-ended free response. This question was intended to provide a “blank slate” opportunity for students to relay any general feedback regarding this method of feedback. The phrasing of this question is similar in all surveys collected; one example is pictured in Fig. 5.
Fig. 5. Survey question taken from SurveyMonkey [11] with an open-ended free response.

4. Results and Discussion

This section presents results, followed by an analysis of positive and negative effects achieved throughout this experiment. Statistical results were collected in accordance with the methodology detailed in the previous section, and are combined throughout this section with subjectively observed effects from my personal account of the audio feedback process. In accordance with hypotheses provided earlier, positive and negative results are divided by measures of efficiency and effectiveness.

4.1 Statistical results.

The complete data set collected using the survey detailed in Subsection 3.3 is available in Appendix 4. In this section, the most pertinent and encompassing summaries are presented.

Numeric values corresponding to each respective response are provided in Table 2. Fig. 6 and Fig. 7 subsequently provide a visual summary of this Likert scale assessment’s distribution.

Table 2. Descriptive statistics of student responses when asked “Receiving audio feedback on the MA103 Modeling Assignment was ______ than receiving written feedback.”

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
<th>AY11-1</th>
<th>AY12-1</th>
<th>AY12-2 (a)</th>
<th>AY12-2 (b)</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
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<td>14</td>
<td>6</td>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>Slightly more helpful</td>
<td>13</td>
<td>23</td>
<td>2</td>
<td>3</td>
<td>41</td>
</tr>
<tr>
<td>4</td>
<td>The same as</td>
<td>7</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>Slightly less helpful</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Much less helpful</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>I didn't listen to the audio feedback provided</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td><strong>Total # Responses</strong></td>
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<td>51</td>
<td>8</td>
<td>8</td>
<td>114</td>
</tr>
<tr>
<td></td>
<td><strong>Mean</strong></td>
<td>4.89</td>
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<td>5.75</td>
<td>5.25</td>
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<td></td>
<td><strong>Standard Deviation</strong></td>
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<td>0.72</td>
<td>0.46</td>
<td>1.04</td>
<td>1.22</td>
</tr>
</tbody>
</table>
Fig. 6. Student responses when asked “Receiving audio feedback on the MA103 Modeling Assignment was __________ than receiving written feedback.”

Fig. 7. Summary of student responses when asked “Receiving audio feedback on the MA103 Modeling Assignment was __________ than receiving written feedback.”
4.2 Discussion of results related to efficiency.

Recall, efficiency is defined as the “ratio of useful energy delivered by a dynamic system to the energy supplied to it” [7]. In our circumstance, instructors’ efficiency is assessed from the amount of energy required to communicate their feedback. Energy costs can be defined several ways. Next, I will use the following questions related to required instructor energy to guide our discussion of relative impacts, advantages, and disadvantages to efficiency.

- Is it easy to establish the necessary tools and skills to execute this technique?
- Is the software capable of effectively capturing instructor needs?
- How do the relative time required in the grading process change using audio with respect to written feedback techniques?
- What other instructor concerns should be considered?

To address the first question listed above, yes, it is very easy to establish and execute the audio feedback technique. The only accessories necessary are a microphone to plug into your computer, and sound recording software. Ideally, Adobe Acrobat 9 is available, and can be set up in accordance with Appendix 3 to facilitate commenting student papers. Depending on the quality of the microphone in use, it may be necessary to enhance the sensitivity of the voice pickup through your recording device. I recommend before several comments are recorded, the first one is tested by playing it back to ensure it is audible for your audience.

Addressing our second question: the sound recorder software cited throughout this paper is easy to use, however, difficult to manage. It can be stopped and started multiple times throughout a recording; however, because no edits are possible (i.e. no additions, deletions, or truncated segments can be made) it is very unforgiving. If a mistake is made during recording, or a segment is interrupted for any reason, a correction cannot be made without deleting the working file and starting over. As the software improves, next generation interfaces will hopefully address this shortcoming.

The next discussion focuses on time required to complete an audio feedback evaluation versus written feedback. This comparison is a difficult because the two likely have very different content. To illustrate this point – consider an equation with a mislabeled subscript. While it would be impractical to fill a page of red ink text with sufficient explanation of the implications of this error, with audio feedback a detailed explanation is more feasible. For reasons synonymous to this example, I found audio feedback was significantly more elaborate in content than written feedback. Time required to complete both, however, was surprisingly comparable. Time saved omitting written remarks was absorbed by additional audio explanations to the student. Appendix 5 provides a sample of 46 audio recorded feedback times with a mean of 12.39 minutes and a standard deviation of 4.46 minutes. While written feedback was not provided and therefore no data is available, I suspect I could have completed the same papers in
slightly less time (approximately 10 minutes each), again however, without the detail possible through audio feedback.

The final discussion included under efficiency is under a topic of general instructor awareness. As an emerging technology, digital media has its precautions as well. Audio feedback requires the instructor’s voice on record, and they must recognize potential implications of this action. Dissemination of the electronic files is readily accomplished, so to be safe an instructor should assume their comments can be heard by their entire student population, not just the individual they are intended for. On one hand, it keeps an instructor accountable for their comments. On the other hand, it opens them up for potential criticism ranging from grading inconsistencies, to misspoken comments, comments taken out of context, or any other issue with potential negative effects. While nothing of this nature was encountered during this study, it is a fact of digital media I remained keenly aware of while recording.

4.2 Discussion of results related to effectiveness.

Recall, effectiveness is defined as “producing a decided, decisive, or desired effect” [7]. Supporting classroom objectives, the desired effect is for students to process, understand, and improve upon the mistakes highlighted in their critique. In light of these criteria, student feedback on this audio technique will be discussed using the following questions.

- Will students take the time necessary to listen to the audio feedback?
- Will students process and understand the audio message the instructor is communicating?
- Will audio feedback help students improve upon their mistakes in the future?

Needless-to-say, no gains in effectiveness are possible without students first taking the time to listen to the audio feedback provided to them. Although no pizza was offered (Subsection 3.4), participation listening to the audio messages after their return was high. Of the 114 total samples assessed, only five students admitted to not listening to the audio feedback file (Appendix 4). One free response comment even read, “I loved it. It was cool and I actually listened to it suprsingly” (Appendix 5).

Students’ ability to effectively understand the critiques communicated in an audio feedback varied among the experimental group. Appendix 4 offers a complete remarks to reference, however, we can extract negative comments related to student understanding against positive ones by subjectively identifying these two categories from among the 66 surveyed with the free response question. Of those open-ended free response answers, six (just shy of 10%) indicated some level of discouragement with their ability to understand the audio comments, and four struggled with the length of audio comments included (which typically spanned between five and fifteen minutes). The majority of remaining comments were varied levels of positive accounts, summing to 43 (roughly two out of three) responses favoring this method to communicate feedback well. Those not accounted for were assessed as neither positive based on their comments.
Our final discussion focuses on students’ ability to improve based on feedback from previous assignments. The purpose motivating this study in Section 3 provides convincing pedagogical logic, to validate this improvement is difficult. One measure is grades; however, grades are subject to other correlating variables such as different assignments, different material, and individual versus group products. With that said, writing assignment averages when successive iterations of audio feedback were used increased both times – in AY11-1 and in AY12-2. In AY11-1, the average rose from 87.1% to 91.4%, and in AY12-2 it rose from 80.5% to 84.0%. (Note: in AY12-1 only received audio feedback their second time. Several quotes from the free response survey question in Appendix 4 reinforce this conclusion. Most of those cited it as insightful to understand more of how the instructor concludes their grade. Others, such as the one below, support improvement directly from previous critiques.

“The thing I must enjoy about the feedback is that I can save it so I can look back on it when ever I can. The first assignment was very useful in this latest assignment because I went back to the told one to listen for what I can approve on and where I did a good job. Overall, I enjoy listening to feedback compared to reading comments on the side of pages.” - Anonymous (AY12-2)

5. Conclusions

5.1 Future research.

Initial results are encouraging, and I look forward to assembling a larger initiative to test and assess student response to audio feedback in writing in mathematics. Four significant adjustments forecasted for continued research next semester (AY13-1) are:

1. Increase the number of instructors participating, therefore providing both a larger student sample size and a means to assess how results are correlated between instructors. It is foreseeable that audio feedback may fit certain instructor personalities better than others, and results may vary among them.

2. For each instructor, create and assess a control group within the student population. This control group will receive feedback in traditional written form. This will serve a dual purpose of both allowing the instructor to compare their required time to execute audio versus written feedback, and a means to compare student responses based on the type of feedback received. Having this dynamic within the same semester ensures as close to parallel circumstance for comparison as possible.

3. Expand the survey design to collect additional data. Additional questions relative to this research could include a Likert scale validations of: relative amount of feedback read and/or listened to, time spent doing so, ease of understanding, and effect on future writing in mathematics products.

4. Expand instructor data collection to include time taken to complete each assessment, both utilizing written and audio feedback.
5.2 Final remarks.

Audio feedback is a relatively easy and effective alternative to provide students feedback on graded assignments. While providing feedback regarding the English classroom aspects of writing such as composition, flow, and communication are important to any writing exercise, the ability to communicate a verbal message in support of writing in mathematics it carries its own unique benefits. Everything from minor nuisance mistakes of mathematical nomenclature to fundamental mathematical error no longer are left to few red pen annotations, but thoroughly articulated through the eyes of the instructor. With 98 of 114 total surveyed students expressing favoritism of this method over written feedback, it is an initiative that I will not only continue to experiment and research with, but one that will likely gain in support and participation in years to follow.
Works Cited


Appendix 1. Navigating the Microsoft Start menu to its Sound Recorder software.
Appendix 2: Returning audio feedback to the student.

Audio feedback returned to the student in a single audio file.

Audio feedback returned to the student in the body of an Adobe pdf document.
Appendix 3: Adobe Acrobat 9 audio feedback option.

1. To open a pdf file in Adobe Acrobat 9, first right click on the desired file and then select the Acrobat 9 option from the menu that appears:

2. With Acrobat 9 now open, select “Customize Toolbars…” from the “Tools” menu:

3. This allows you to customize options that will subsequently appear as shortcut tools

- The “Record Audio Comment” icon is used to insert audio feedback into the pdf document.
- The “Sound Recorder” then appears to record audio segment.
- Customized shortcut tools are put into use quickly with a single click.
Appendix 4: Survey data and responses collected.

Responses to each of the two survey questions described in Subsection 3.3 are provided here. All responses are included, and consolidated by question. The Likert scale question is provided first followed by all open-ended free response answers.

Likert scale question survey results.

This question read: “Receiving audio feedback on the MA103 Modeling Assignment was ________ than receiving written feedback.” Selection options and results by academic year are provided below.

<table>
<thead>
<tr>
<th>Score</th>
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<td>1</td>
<td>I didn't listen to the audio feedback provided</td>
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</tr>
</tbody>
</table>

Open-ended free response survey results.

Free response results in this section are shown as received. No modifications (spelling, punctuation, or otherwise) have been made to the comments received.
Appendix 4 (Continued from previous page…): Survey data and responses collected.

AY12-1

E2. I liked/disliked the audio feedback technique because...

There were 51 total responses.

1. It gave you a sense of the thought process of the instructor as he was grading your assignment
2. I liked the audio feedback because I didn't have to sit down and read all of the hand-written feedback. I actually sat and listened to what my instructor had to say instead of skimming through his hand-written notes.
3. Allowed him to add more detailed information that I could follow along with myself.
4. I disliked the audio feedback, because I had more questions listening to it than I would've had just reading comments and since I was simply sitting at my computer with headphones on instead of actually with the instructor, I couldn't actually ask or get answers to those questions.
5. It was a little awkward having to listen instead of having a visual.
6. I liked it because it was more personal than written remarks on a page
7. It was very different and somewhat humorous
8. It was pretty innovative. I have never had a teacher send me an audio recording of detailed feedback of my work.
9. It was very detailed.
10. I liked the audio feedback because it provided a more in depth explanation of the instructor's thoughts on our paper.
11. The audio feedback gave good detail over what could be improved or what we did wrong rather than just marking something and stating a one or two word remark and moving on.
12. It was different
13. On paper it's more visual, easier to grasp what we did well and needed to improve
14. I liked it because it told me everything I needed to know.
15. It was as if you were just talking to us, it was extremely easy. We didn't even have to read, just sit and listen.
16. I liked the audio feedback because it was easy to understand the method behind the grade.
17. I liked it because it was just a change up.
18. I didn't.
19. I enjoyed it because it was something different and very helpful.
20. I loved it. It was cool and I actually listened to it surprisingly.
21. I did not listen to it.
22. I didn't like it as much because he couldn't really point out the stuff on the actual project, he could only speak about it. I am more of a visual learner.
23. .
24. It was very long and it took a while to listen to the whole thing.
25. I am better with things written down.
26. I did not listen to the audio feedback. I read the comment on my paper.
27. I liked the audio feedback technique because it was quick and precise.
28. It was very informative and told me exactly what I needed to improve on.
29. I liked the audio feedback because it gave me a more in depth answer to what we did well, or not so well in our project, and it made it very clear what you were looking for.
30. It allowed me to receive very detailed feedback on the project.
31. It was good to receive the feedback in an audio format so I could sit back and listen and follow along in my project with what the instructor was saying.
32. Made comments much more personable and detailed.
Appendix 4 (Continued from previous page…): Survey data and responses collected.

33. I liked it just because it was different, however I do like seeing actual written words.
34. It was a personalized process that helped me understand my mistakes.
35. I liked the audio feedback because it offered very personal and in depth information on my project.
36. I actually spent the time to go over the comments.
37. It could go more in depth than writing.
38. I like it because it was different.
39. I liked the audio feedback because it allowed for me to look at my paper and follow along what he was saying as he was saying it.
40. It could help the teacher elaborate on his thoughts.
41. I liked the audio feedback because it offered very personal and in depth information on my project.
42. I actually spent the time to go over the comments.
43. It could go more in depth than writing.
44. I like it because it was different.
45. I disliked it because it took a very long time to listen to something that could've just been written on a paper.
46. It showed that Major Weld took the time to look and analyze at our project and he could go more in depth with the audio feedback.
47. It gave me feedback that I could play over again, so if I missed one comment, I could revisit it.
48. I liked the audio feedback technique because I could understand his remarks better and more clearly.
49. I disagreed with it because it took a very long time to listen to something that could've just been written on a paper.
50. It showed that Major Weld took the time to look and analyze at our project and he could go more in depth with the audio feedback.
51. It gave me feedback that I could play over again, so if I missed one comment, I could revisit it.
52. I enjoyed listening to it and it was easier to understand what he was saying as well as I got more feedback than a written review gives.
53. MAJ Weld was able to relate the positives and negatives better.
54. n/a
55. The time consuming manner it took.
56. You can get more out of audio than a few written notes.
57. It allowed me to see where my partner and I went wrong and where we did well.
58. It was as effective as written feedback.
Appendix 4 (Continued from previous page…): Survey data and responses collected.

AY12-2. Two surveys were collected. One occurred immediately following the course individual writing assignment, and one following the course project. Those results are shown in succession below, and annotated appropriately.

[Individual Writing Assignment Responses]: Please provide any other thoughts or feedback on the audio feedback technique used (i.e. too much or too little, easy or hard to understand, ways to improve, etc.).
There were 7 total responses.

1. It was easy to understand but I like having writing.
2. I believe the audio feedback gave a more realistic experience as if the teacher was grading the assignment with you and going over the points that you struggled with and needed to understand more clearly.
3. I like it a lot. Very interactive.
4. It was a lot easier to understand than having it written, and I think I was able to get more out of listening to the corrections then reading them.
5. It was great!
6. I enjoyed the audio feedback because I was able to listen to your comments while look at my work at the same time. Also, I can replay the audio whenever I want if I am unclear about something.
7. I liked it because the instructor was able to explain their reasons thoroughly.

[Group Project Responses]: Please provide any other thoughts or feedback on the audio feedback technique used (i.e. too much or too little, easy or hard to understand, ways to improve, etc.).
There were 8 total responses.

1. I like this method because you are able to say more with audio that would be with written feedback.
2. I enjoyed listening to the audio feedback. The only real disadvantage to it is not being able to give questions yourself and maybe occasionally having your computer malfunction but other than that I enjoyed it.
3. In all honesty I love the audio feedback. I like how you talk us through each part of the paper. I would not like it if you did not break it up into sections but you do and I feel like I learn about better. I can also come into class the next day with questions regarding your feedback if that is the case. The thing I must enjoy about the feedback is that I can save it so I can look back on it when ever I can. The first assignment was very useful in this latest assignment because I went back to the told one to listen for what I can approve on and where I did a good job. Overall, I enjoy listening to feedback compared to reading comments on the side of pages.
4. easy to follow and understand
5. The only objection I have to the audio feedback is that you have to listen over and over again if you are trying to find why you did something wrong because sometimes you aren't able to write or understand everything that is going into the problem to make the corrections or understand it because it is going fast or your trying to put words with the problem and don't see the correlation.
6. I like the audio feedback but I would rather have written feedback because I can't always look listen to it. I also just like to not use my computer when it comes to projects.
7. It was easy to understand.
8. easy to understand, but not as easy to really get to it and listen to it. Written feedback I see it right away. Sound, I actually don't really care to listen to it because I have to do a lot to get to it.
Appendix 5: A sample of completion times for individual writing assignments with audio feedback completed.

The data below was collected from the “Date Modified” time-stamp assigned to the recorded audio files. Under the assumption that following completion of one paper grading on the next began, the elapsed time per paper is calculated.

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Total Samples 46
Mean 14.39
Standard Deviation 4.46

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