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Increasing Learner Engagement in Online Learning through Use of Interactive Feedback: Results of a Pilot Study

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Abstract

Technologies for eLearning continue to evolve and provide additional mechanisms for teaching and facilitating learner engagement. As the number of engineering courses and programs provided in an online format continues to increase, the need for evaluating the efficacy of these eLearning tools also increases. One of the main concerns in online learning is learner persistence, so technologies and pedagogies that support persistence are especially important. A growing body of literature suggests that when students feel connected and supported, they are more likely to continue with a program. Finding ways to accomplish this support and engagement for online programs then is a significant factor in program delivery.

In this paper we report on the results of a pilot study that examined the use of text-based and interactive feedback using the framework of the Community of Inquiry (COI) Model. This model includes elements of cognitive presence, social presence and teaching presence which are associated with student engagement, connectedness and support. The pilot was conducted over two semesters in an online engineering course at the University of Cincinnati. Students were provided both traditional text-based feedback on assignments and interactive feedback. Surveys were administered to measure students' response to both forms of feedback and to gauge how both forms of feedback impacted elements of the COI Model.

The pilot study indicates that feedback has the greatest impact on teacher presence with smaller association with social presence and cognitive presence. The use of interactive feedback was certainly appreciated by the students but perhaps of more importance is timeliness of feedback and personalizing feedback to the individual. Student engagement is improved with the use of interactive feedback but the effort to provide this type of feedback may not be warranted for all courses.

Introduction

Garrison, Anderson, and Archer[1] have developed a theoretical framework for representing the process of learning and creating meaning. The community of inquiry model includes three interdependent elements – cognitive presence, social presence, and teaching presence. Cognitive presence refers to the extent that students are able to construct meaning and knowledge through sustained communication. Social presence is described as the propensity for students in a learning setting to authentically present their personal traits and attributes into that setting. Teaching presence is described as the design, implementation and oversight of instruction and instructional processes in order to achieve prescribed learning outcomes. A significant aspect of each of these three elements relies on interactions between the instructor and the students so pedagogies or technologies that significantly modify the nature and extent of interactions can have effects on the model. Table 1 illustrates methods for coding student behaviors that are indicative of the three elements of the model.

Table 1 Community of Inquiry Coding Template

Elements	Categories	Indicators (example)
Cognitive Presence Q4, Q5	Triggering Event	Sense of puzzlement
	Exploration	Information exchange
	Integration	Connecting ideas
	Resolution	Apply new ideas
Social Presence Q3,	Emotional Expression	Emoticons
	Open Communication	Risk-free expression
	Group Cohesion	Encouraging collaboration
Teaching Presence Q1, Q2, Q6, Q7, Q8, Q9	Instructional Management	Defining & initiating discussion topics
	Building Understanding	Sharing personal meaning
	Direct Instruction	Focusing Discussion

(After Garrison, Anderson, & Archer[1], 2000, p. 4)

Table 1 also lists the survey questions (discussed in the Results section) that are associated with specific elements of the COI model.

As technology changes, so does our need to explore and evaluate effectiveness of these technologies. This is particularly true of online courses and programs that rely on a variety of technologies for their effective development and implementation. Feedback from instructor to students affects all elements of the COI model and is dependent on technology in online courses.

In previous studies, the primary point of discussion has focused on the technology employed to deliver feedback as Chen, Whittinghill and Kadlow[2] discuss in their review of clickers for rapid feedback. While exploring the adoption and acceptance of such technologies is useful, so is the importance of studying the impact of feedback, and its form, on student learning using the COI framework. Previous studies (Ice, Curtis, Phillips & Wells[3]; Dias & Trumpy[4]) offer a deeper understanding on students' experience and sense of social presence as a result of audio feedback strategies, reflecting students' value for effectiveness and efficiency in the context of audio-based feedback.

Feedback to Improve Students' Perception of Engagement

Harper[5] proposed that instructors are in search of meaningful methods for promoting interactivity and engagement. Proper attention to instructional design informs us that appropriate and regular feedback is a necessity for meaningful learning. When considering feedback we should consider both the mechanisms we use to provide feedback to students, particularly in online courses, as well as students' perceptions of quality feedback, which is likely to vary from one student to the next. Using audio as a means to provide feedback has been employed as early as the 1960s and research regarding the effectiveness of audio feedback as an instructional tool has also been investigated for many years (Tanner[6] and McGrew[7]).

In recent studies comparing the use of text versus audio-based feedback (Haper[5]; Halupa & Bolliger[8]) findings indicated that students valued both methods of feedback (text and audio), but primarily valued audio-based feedback for the added ability to express nuance through voice and

intonation. Other critical studies include a study by Halupa & Bolliger[8] that supported students' valuation of the feedback, and provided further data to illuminate students' perceptions and preferences that prevented them from engaging with the formative feedback provided by instructors. Students' perceptions do seem to correlate to their participation and interest around engaging with feedback in their courses. This may be due to the nature of written feedback as being perceived as a one-way (Stone[9]) experience from instructor-to-student, even though the act of reading is required to complete the feedback loop. As with other research studies, Stone[9] confirms the ongoing rhetoric surrounding feedback methods in online courses in that it is necessary and more than often, welcomed by students who are generally open to the experience.

Student Perception of Feedback in Online Learning

Moore's[10] (1993) theory of transactional distance proposed a structure for examining communications in online environments. Within this framework, Moore[10] (1993) proposes quality over quantity for a productive and successful interaction online. While this theoretical framework can provide a guide for ways in which we can consider the impact of feedback (i.e. frequency, tone, method), we should also consider how students perceive these interactions.

In a more recent study (Dias & Trumpy[4]) explored the use of formative feedback via written and audio feedback in an online classroom. From this study, Dias & Trumpy[10] found that students generally found audio-based feedback to be more accessible. These studies shed light on perceived benefits of efficiency but have not used the lens of the Community of Inquiry and fail to measure whether students feel more 'connected' when a particular method of feedback is used. Lamport & Bartolo[11], in a recent study focused on exploring student perceptions of online instructional practices, discovered elements that students perceived as having promoted a stronger sense of community, which included timely teacher feedback. It is evident that feedback is necessary, but our understanding of how students perceive it in the context of 'presence' related to the Community of Inquiry, may help us to better understand what feedback should look, feel, sound and be like to make its greatest impact.

Methods for Investigating Use of Interactive (Audio) Feedback

Two distinct but related investigations were performed to assess the impact interactive feedback had on learner engagement using the COI model as a framework. Both investigations were "housed" within a course taken by upperclassmen and first year graduate students. This particular course, Effectiveness in Technical Organizations, is an elective course that addresses professional skills such as communication, team work and leadership. Assessment of student learning is measured in large part by reflective papers written by the students.

The first investigation was completed during the 2013-2014 academic year and included 40 students. During the first half of the semester students received text-based feedback on their written assignments (this method had been used by the instructor for the previous five years). During the second half of the semester, students received interactive feedback on their written assignments. In all cases the feedback was provided to the students via the university's leaning management system. Interactive feedback was created by first making written comments on a student's assignment then using Screencast-o-matic to record audio and the instructor's computer screen to expound on the written comments and make summary comments. Figure 1 provides a screenshot of what a student would see to "play" the interactive feedback.

Students were given a survey at the mid-term (when they had received text-based feedback) and conclusion (when they had received interactive feedback) of the course. The survey was adapted by permission from the COI database at Athabasca University[12]. This survey is reported in Appendix A. In addition students were given a traditional end-of-course survey that also included open-ended questions related to feedback on written assignments.

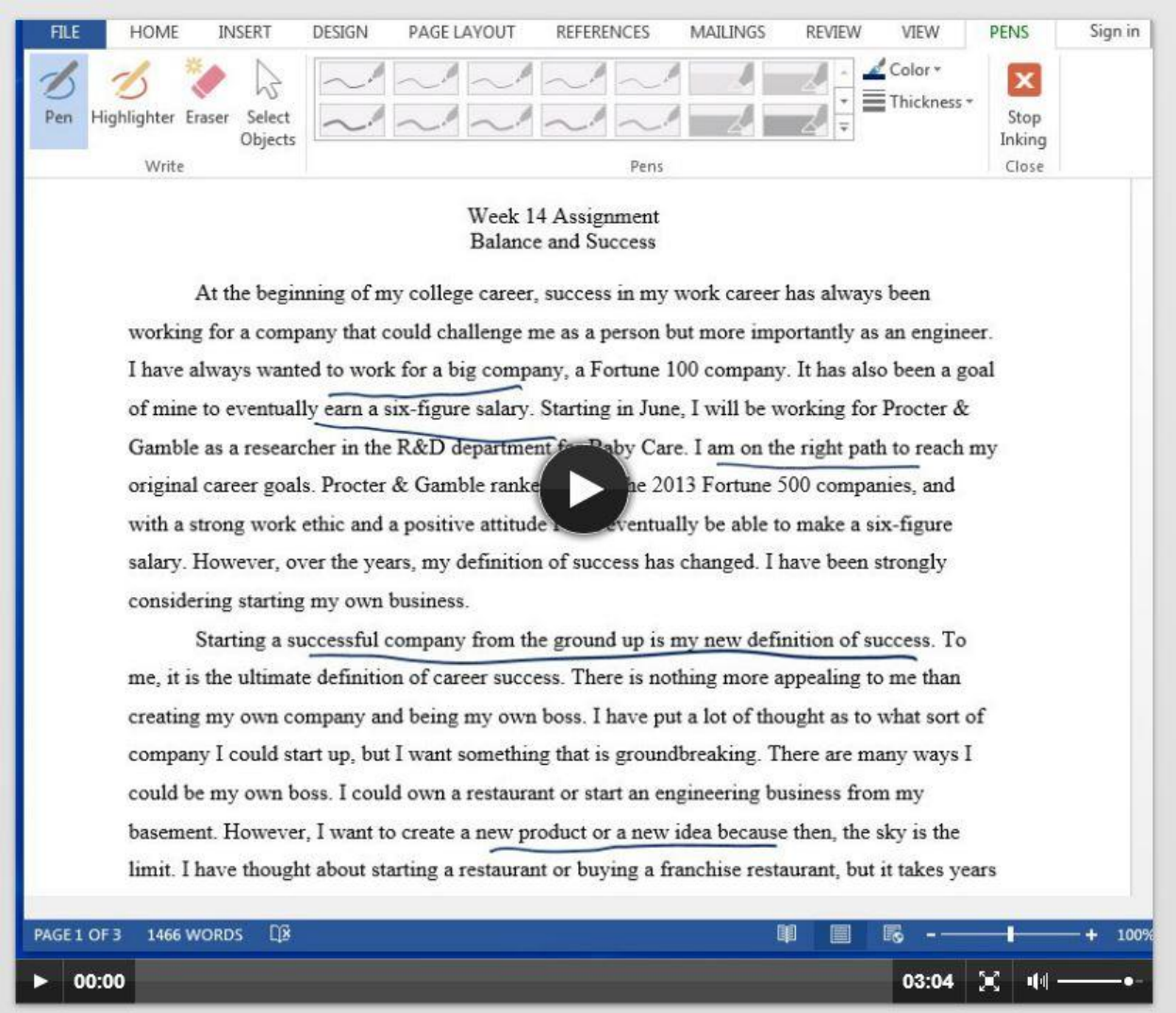

Figure 1 Example of Interactive Feedback

As the response rates obtained in the first assessment were less than hoped for, the evaluation was repeated, albeit in a modified form. The second investigation was completed during the 2014-2015 academic year. During the term the course was taught, text-based feedback and interactive feedback were provided on an alternating basis such that students received each type

of feedback on half of the written assignments. Students were administered an end-of-course survey that sought to more directly measure their satisfaction with both forms of feedback and have the students indicate explicitly which form of feedback was better from a COI construct.

Results

Survey results intended to directly measure elements of the COI model for the 2013-2014 investigation are provided in Table 2. In the survey, interactive feedback was referred to as audio feedback. The "format" column refers to the method of receiving feedback (text for the 1st half of the semester, interactive for the 2nd half of the semester). The questions are paired so that differences resulting from the mode of feedback are more evident Participation was voluntary and disappointing. Only 9 students responded to the survey regarding text-based feedback and 14 to the survey regarding interactive feedback. The responses are in the form of a Likert scale ranging from Strongly Disagree to Strongly Agree.

Table 3 provides representative comments from the traditional 2013-2014 end-of-course survey that relate to feedback on written assignments as they pertain to the community of inquiry model. Participation in this survey was somewhat better, 25 students, than in the other surveys. The number of comments related to that particular aspect of the model are also indicated in parenthesis.

Survey results from the 2014-2015 course are presented in Tables 4, 5 and 6. Table 4 provides responses for Likert scale questions; Table 5 provides responses directly comparing the two formats; Table 6 provides representative responses to an open-ended comparison of the two formats. Response rates for this survey were better with 25 out of 46 students participating.

Social Presence (Question 3)

Given the nature of this study, this element was measured based on a student's feeling of connectedness to the course and course content as a result of the structure and deliver of the course. From Table 2, it is clear that both forms of feedback helped students feel connected to the course, with interactive feedback having somewhat more positive results. Four students from 2013-2014 provided open ended responses that support the improved social presence facilitated with the interactive feedback (see Table 4). From Table 5 we also conclude that interactive feedback is somewhat better at promoting social presence as compared with text-based feedback.

Teaching Presence (Questions 1, 2, 6, 7, 8, 9)

This aspect of the Community of Inquiry was most evident in students' response to the design of the course. While the students expressed a value and appreciation for instructor feedback, they often equally, and in the same context, discussed the design and organization of the course as a valuable feature in their experiences online.

Table 2 Survey Results 2013 – 2014 (Text n=9; Audio n=14)

Question	Format	SD	D	Neither D or A	A	SA
Q1 When using text-based feedback, the instructor's made his / her intent clear **TP**	Text			11%	67%	22%
Q1 When using audio feedback, inflection in the instructor's voice made his / her intent clear. **TP**	Audio				29%	71%
Q2 The instructor's intent was clearer when using text-based feedback than without feedback **TP**	Text			22%	22%	56%
Q2 The instructor's intent was clearer when using audio than text. **TP**	Audio			7%	36%	57%
Q3 Text-based comments made me feel more involved in the course. **SP**	Text			33%	44%	22%
Q3 Audio comments made me feel more involved in the course than text based comments. **SP**	Audio			8%	46%	46%
Q4 Text-based comments motivated me more. **CP**	Text		11%	11%	56%	22%
Q4 Audio comments motivated me more than text-based comments. **CP**	Audio			21%	43%	36%
Q5 I retained the text-based comments. **CP**	Text			11%	89%	
Q5 I retained audio comments better than text-based comments. **CP**	Audio		7%	21%	57%	14%
Q6 Text-based comments were personal. **TP**	Text	3%			44%	22%
Q6 Audio comments are more personal than text based comments. **TP**	Audio		7%	7%	43%	43%
Q7 Receiving text-based comments made me feel as if the instructor cared about me and my work. **TP**	Text			11%	56%	33%
Q7 Receiving audio comments made me feel as if the instructor cared more about me and my work than when I received text-based comments. **TP**	Audio			7%	29%	64%
Q8 The instructor provided feedback in a timely fashion. **TP**	Text				44%	56%
Q8 The instructor provided feedback in a timely fashion. **TP**	Audio				21%	79%
Q9 The instructor provided feedback that helped me understand my strengths and weaknesses. **TP**	Text				67%	33%
Q9 The instructor provided feedback that helped me understand my strengths and weaknesses. **TP**	Audio				50%	43%

Table 3 Student Comments from 2013 – 2014 That Inform the COI Model Evaluation

Question (# comments)	**Representative Responses**
Q1 The instructor's made his intent clear **TP** **(2)**	"The feedback method adopted by the professor was amazing and intuitive as compared to the text comments. It really provides an overall view of what we have written as per the instructor's perspective."
Q3 Feedback made me feel involved in the course. **SP** **(4)**	"I liked the feedback to my papers. There was usually a question asked by the instructor in the feedback we received which made me think about what I wrote even more and view my thoughts differently." "The auditory feedback was great, you were not only able to hear what he was saying, but I was also able to see what was wrong with my paper at the same time receiving the feedback. The comments I received also seemed to be in grained in my mind so when writing for the next assignment, I would be thinking about what he had said in the previous videos"
Q4 Feedback I received motivated me. **CP** **(2)**	"I would say the auditory feedback made me pay more attention to what I needed to improve/fix throughout my papers as opposed to just writing "this needs to be fixed." I received more feedback on why I got the grade I did and what I did wrong and what I could do to improve it. When you watch a video on being critiqued (well for me at least), I'm more focused and tuned in."
Q6 The feedback was personal. **TP** **(7)**	"I don't think there is necessarily a difference in how personal it (one mode or the other) is. It did allow you to catch the professor's tone more easily." "I think audio is more personal. Additional ideas were discussed and many key things that you might not include in writing were discussed in the video. It allows you to connect to the professor more since you actually hear his voice instead of just seeing words typed out on the screen." "The feedback was great. Actually it was much better than all of my classroom instruction classes."
Q7 Receiving feedback made me feel as if the instructor cared about me and my work **TP** **(2)**	"(Audio feedback) is almost like being sat down and conferred on a paper or assignment."
Q9 The instructor provided feedback that helped me understand my strengths and weaknesses. **TP** **(9)**	"I much prefer the auditory feedback, because you knew exactly what you did wrong and right and it helped when trying to complete assignments down the road." "Comments are always helpful and I enjoyed the auditory feedback. Was beneficial to see what specific parts were good/not so good."

Table 4 Survey Results part 1 2014– 2015 (n=25)

Question	N/A	SD	D	Neither D or A	A	SA
Q8 I received feedback on written assignments in a timely fashion **TP**					36%	64%
Q1 When the instructor used text-based feedback on written assignments, the instructor made his intent clear **TP**			4%	8%	40%	48%
Q1 When the instructor used audio-based feedback on written assignments, the instructor made his intent clear **TP**	16%			4%	32%	48%
Q6 Text-based feedback on written assignments was personal **TP**		4%	4%	8%	48%	36%
Q6 Audio-based feedback on written assignments was personal **TP**	16%	4%		12%	20%	48%
Q7 Receiving text-based feedback made me feel that the instructor cared about me and my work **TP**				4%	36%	60%
Q7 Receiving audio-based feedback made me feel that the instructor cared about me and my work **TP**	16%			4%	28%	52%
Q9 The instructor provided feedback that helped me understand the strengths and weaknesses of the assignment **TP**				8%	32%	60%

Table 5 Survey Results part 2 2014– 2015 (n=25)

Question	N/A	Text Much More	Text More	Same	Audio More	Audio Much More
Q3 Which form of feedback on written assignments made you feel more involved in the course? **SP**	4%	16%	8%	36%	24%	12%
Q4 Which form of feedback on written assignments motivated you more? **CP**	8%	20%	0%	40%	20%	12%
Q1 The instructor's intent was clearer when using one form more than the other form of feedback. **TP**	12%	12%	8%	32%	28%	8%

Table 6 Survey Results part 3 2014– 2015 (n=25)

Which form of feedback did you prefer?	
Audio	"Audio based feedback made me feel that the instructor cared about me and I get motivated when I hear about my work." Q7
	"I think I prefer audio-based feedback slightly more than text-based since it seemed more personal. Since it is an online class, it can sometimes seem like you are just completing assignments just to do them and that you are not really involved in the class. The audio feedback was a nice touch that helped you get a more personal, and sometimes clearer understanding of how you did on the assignment." Q6, Q9
Neutral	"Both meant pretty much the same to me. The audio-based feedback was marginally more informative"
	"They are almost equal to me. But text-based feedback is more convenient to watch."
Text	"I prefer text based feedback because I can read the feedback anywhere however I need a way to listen to it because I have a baby that sleeps next to my office and my wife will murder me if I wake up the baby."
	"Text seems more clear." Q1
Not Paying Attention	"I did not realize that we had audio based feedback. I am content with text-based feedback. I would think that audio feedback would be awkward to receive online."
	"I did not ever receive audio-based feedback but I felt that the text-based feedback was very helpful and done with more effort than many other classes I've taken."

The data provided in Tables 2 – 3 indicate a strong increase in teacher presence with interactive feedback as compared with text-based feedback. The first four rows in Table 2 indicate students' experienced audio feedback as clearer in conveying instructor intent. Student responses to questions 6 and 7 of Table 2 likewise indicate that students felt interactive feedback was more personal and indicated a greater degree of concern from the instructor as compared with text feedback. Responses to question 9 from Table 2 seems to indicate that both methods of feedback are about equal in helping students understand strengths and weaknesses of an assignment. From Table 3, questions 6 and 9 generated many student comments, the majority of which indicated an improved teacher presence when interactive feedback was used.

Data from 2014-2015 in Tables 4 and 5 seems to support that interactive feedback provides for a greater teacher presence than does text-based feedback. Responses to other questions from Tables 3 – 4 did not reveal differences in teacher presence with one form of feedback versus another.

Cognitive Presence (Questions 4 & 5)

This aspect of the Community of Inquiry model was most evident in students' expressed motivation. Responses to question 4 as posted in Tables 2 and 4 indicate a somewhat enhanced cognitive presence with interactive feedback but this element generated less open-ended

responses than other elements. Likewise data from 2014-2015 shown in Table 5 indicates a somewhat increased cognitive presence with interactive feedback, but the differences are not dramatic.

Discussion

The nature of the investigation and interventions related more to teacher presence than cognitive presence or social presence. However, the responses from 2013-2014 indicated the interactive feedback promoted all three elements of the model to a greater level than text-based feedback. Student responses from 2014-2015 had consistent results as those from the previous year but the differences were not as distinct.

The nature of the two investigations likely leads to varying results. While we cannot be certain, we conclude that the difference in methods has led to a difference in outcomes regarding the COI model with the methods used in the first year favoring the newer form of feedback. Providing the novel interactive feedback then asking questions of the form "x was more significant with audio feedback then text-based feedback" likely led students to rate interactive feedback quite highly as contrasted with the methods used in 2014-2015. The responses in Table 5 indicate a near balance among favoring text, favoring interactive and being neutral about the difference.

Open ended responses provide a somewhat different picture. Most comments favored the interactive audio feedback and provided strong support for increased (teaching, social, or cognitive) presence in the COI context.

Not surprising but disappointing, several students did not bother to listen to any audio feedback and seemed to not even know it had been provided.

It is worth noting the work load on the instructor for providing feedback to students. In providing text-based feedback, the instructor would make written comments on a paper as it was reviewed then provide summary comments. This was all done within the learning management system. In providing interactive feedback, the instructor would likewise make written comments on a paper as it was reviewed. The instructor would then launch Screencast-o-matic and provide audio comments while scrolling through the paper. The instructor would then save the media file, copy the link to the file and paste that link in the summary comments provided to the students within the learning management system.

The course instructor reports that the process of providing the interactive feedback takes twice as long as just providing the text-based comments. This is consistent with findings from other studies (Dias and Trumpy[4]).

Conclusions

Interactive feedback is generally valued by students and leads to improved teacher presence and to a lesser extent improved cognitive presence and social presence. Comments generally support that interactive feedback is more personal and provides comments that are more helpful in understanding a student's performance on an assignment.

It is also clear that any form of feedback, thoughtfully provided, is greatly valued by students. Comments suggest that students do not feel they are routinely provided sufficient feedback on assignments.

The process of providing interactive feedback, at least as implemented by the instructor in this study, is more time consuming than providing traditional written feedback. It is not at all clear that the results achieved justify the additional time needed to provide this type of feedback. This study suggests there were gains in terms of the COI model and that is worthwhile. The particular course however has high retention rates and consistently positive course evaluations and levels of student engagement. It would be instructive to implement interactive feedback in a course / program that had issues with retention and measure changes in attitude and retention. Instructors should carefully consider what outcomes they hope to achieve before implementing interactive feedback.

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References

1. Garrison, D.R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. Internet and Higher Education, 2, 87-105.

2. Chen, J. C., Whittinghill, D. C., & Kadlowec, J. A. (2010). Classes that click: Fast, rich feedback to enhance student learning and satisfaction. Journal of Engineering Education, 99(2), 159-168.

3. Ice, P., Curtis, R., Phillips, P., & Wells, J. (2007). Using Asynchronous Audio Feedback to Enhance Teaching Presence and Students' Sense of Community. *Journal of Asynchronous Learning Networks*, *11*(2), 3-25.

4. Dias, L. P., & Trumpy, R. (2014). Online Instructor's Use of Audio Feedback to Increase Social Presence and Student Satisfaction. Journal of Educators Online, 11(2).

5. Harper, B. E. (2009). I've Never Seen or Heard It This Way! Increasing Student Engagement through the Use of Technology-Enhanced Feedback. *Teaching Educational Psychology*, *3*(3), n3.

6. Tanner, B.(1964). Teacher to disc to student. The English Journal,53 (5), 362-363.

7. McGrew, J.B. (1969). An experiment to assess the effectiveness of the dictation machine as an aid to teachers in the evaluations and improvement of student compositions. Report to Lincoln Public Schools, Lincoln, Nebraska (ERIC Document Reproductive Service No. ED 034776).

8. Halupa, C., & Bolliger, D. U. (2013). Student Perceptions on the Utilization of Formative Feedback in the Online Environment. *International Journal of Online Pedagogy and Course Design (IJOPCD)*, *3*(2), 59-76.

9. Stone, A. (2014). Online assessment: what influences students to engage with feedback? *The clinical teacher*, *11*(4), 284-289.

10. Moore, M. G. (1993). Theory of transactional distance. *Theoretical principles of distance education.*

11. Lamport, M., & Bartolo, P. (2012). Student Perceptions of Online Instructional Practices that Enhance Connectedness: Themes Toward the Development of an Instrument. Retrieved January 30, 2015, from https://cirt.gcu.edu/jir/volumes/2012v1

12. CoI Survey. (n.d.). Retrieved January 20, 2015, from https://coi.athabascau.ca/coi-model/coi-survey/

Appendix A
Community of Inquiry Survey Instrument (draft v14)

Teaching Presence
Design & Organization
1. The instructor clearly communicated important course topics.

2. The instructor clearly communicated important course goals.

3. The instructor provided clear instructions on how to participate in course learning activities.

4. The instructor clearly communicated important due dates/time frames for learning activities.

Facilitation
5. The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn.

6. The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking.

7. The instructor helped to keep course participants engaged and participating in productive dialogue.

8. The instructor helped keep the course participants on task in a way that helped me to learn.

9. The instructor encouraged course participants to explore new concepts in this course.

10. Instructor actions reinforced the development of a sense of community among course participants.

Direct Instruction
11. The instructor helped to focus discussion on relevant issues in a way that helped me to learn.

12. The instructor provided feedback that helped me understand my strengths and weaknesses.

13. The instructor provided feedback in a timely fashion.

Social Presence
Affective expression
14. Getting to know other course participants gave me a sense of belonging in the course.

15. I was able to form distinct impressions of some course participants.

16. Online or web-based communication is an excellent medium for social interaction.

Open communication
17. I felt comfortable conversing through the online medium.

18. I felt comfortable participating in the course discussions.

19. I felt comfortable interacting with other course participants.

Group cohesion
20. I felt comfortable disagreeing with other course participants while still maintaining a sense of trust.

21. I felt that my point of view was acknowledged by other course participants.

22. Online discussions help me to develop a sense of collaboration.

Cognitive Presence
Triggering event
23. Problems posed increased my interest in course issues.

24. Course activities piqued my curiosity.

25. I felt motivated to explore content related questions.

Exploration
26. I utilized a variety of information sources to explore problems posed in this course.

27. Brainstorming and finding relevant information helped me resolve content related questions.

28. Online discussions were valuable in helping me appreciate different perspectives.

Integration
29. Combining new information helped me answer questions raised in course activities.

30. Learning activities helped me construct explanations/solutions.

31. Reflection on course content and discussions helped me understand fundamental concepts in this class.

Resolution
32. I can describe ways to test and apply the knowledge created in this course.

33. I have developed solutions to course problems that can be applied in practice.

34. I can apply the knowledge created in this course to my work or other non-class related activities.