9-30-2015

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Abstract— **Students with a technology focus often express and demonstrate that they find it difficult to communicate their ideas and designs. Students in the Rochester Institute of Technology's School of Interactive Games and Media are further challenged in that in order to be successful in their pursuit of a career in game design and development, they need to effectively convey their game ideas and design specifications while expressing the passion for the ideas that will convince others to climb on board and work on their projects. In this paper, we discuss the way we help our students develop these skills within a course structure. Through several course offerings, the faculty and students anecdotally noted that the students communication skills improved and their comfort in communication improved as well. In order to more accurately determine if this observed improvement was measurable, a survey of comfort with communication skills was created. The paper will present the results of an exploratory study using the instrument, which involved administering the survey to the students in the course as well as students in another course without a focus in development of these skills. The results from both sets of students were analyzed to determine if there was an increase in comfort with communication skills and to begin a process of validating this new instrument.**

Keywords— communication skills; professional skills; game production

I. INTRODUCTION

Today's students in technical fields must navigate several challenges to be successful within the workplace. Along with a command of technical skills and the ability to be adaptable as technology changes, students of the technical discipline must also be adept at skills such as verbal and written communication. Although this statement is not revolutionary, technical disciplines are becoming increasingly reliant upon collaboration and teamwork. In the past, employees with extreme technical skill could sometimes be considered "exempt" from interacting with their colleagues. Today's reality is that most employers can no longer tolerate a mindset of isolated productivity. Employees must be able to present their ideas in a convincing manner, and must be skilled in the arts of presentation, persuasion, critique, and mediation.

Although this has been a pervasive problem, educators are still challenged in the classroom to provide learning experiences that focus upon communication skills in a convincing context. However, we often make such exercises peripheral to the technical content, often separating the technical creation and the essential communication tasks such as ideation, presentation, and documentation. Such tasks are only a minor component of technical assignments, with the occasional course requiring a culminating communications-based project, such as an end-of-term report or a final presentation. Even in such cases, these tasks are a portion of the assessment and often have a marginal impact on the overall assignment assessment.

Today's challenge addresses the question of how to we actually create authentic technical and educational processes and practices that allow faculty to explore successful and even unsuccessful communication and interaction patterns with students. Furthermore, how do we move beyond treating communication skills as an extra and separate component to the technical work?

To help frame this exploration, there are two basic levels: finding means to determine levels of communication comfort in learners and finding means to link technical and communication educational outcomes in course design. This paper addresses our initial results in exploring the first task – comfort level with communication skills in a technical discipline.

II. BACKGROUND

Communication skills in general have been recognized as important for some time. ABET gives specific focus for such skills in applied science, computing and engineering programs as a desired course and program outcome [1][2][3]. Given the importance, there are several approaches to including these skills in the curriculum. Institutions readily recognize the importance and have developed approaches that best work for them and their curriculum and students.

A. Integrating Communication throughout the Curriculum

The PITCH program [4] aimed to integrate communication skills for engineering and computer science undergraduate students throughout the entire curriculum. This program focused on multiple aspects of communication that include written documents, poster presentations, oral presentations, and design reports. The students were given various types of assignments throughout their four years. The faculty focused on making rubrics and samples available to the students ahead

of time as a means of instruction on proper communication techniques.

At SUNY Oswego, communication skills were integrated in the curriculum by adding a required technical writing course and adding elements to other courses (e.g. reports, presentations) as well as adding a multi-disciplinary team aspect to some team projects [5].

In Australia, Falkner and Falkner also touted the advantages of integration across the curriculum and actually propose a methodology by which others can design communication skills curricula [6].

B. Taking outside courses

Although not as popular, some institutions require one or more additional outside courses for their students. For the Information Technology department at University of Cincinnati, the students are required to complete specific communication courses. The senior design capstone for these students is viewed as a culminating experience where they bring the communication pieces and their IT curricula together [7].

C. Communications Course within Curriculum

Still another approach is to create a stand-alone communications course inside the technical curriculum. University of Toronto did this with their "Communication Skills for Computer Scientists" course [8]. This course focused on writing, speaking, and interpersonal communication. Students were asked to deliver a number of speeches throughout the term ranging in duration from 60 seconds to 5 minutes. Within these assignments, they were asked to describe information from a graph or chart, participate in a mock interview, and to present a topic of interest. They were coached through this process; videos of the speeches were posted online for comment and critique by instructor and student alike.

In [9], we see another instance of a course within the department created for introducing communication skills that focused on writing and oral skills through the use of lab sessions. At the end of his paper, Lawrence argues that one course is simply not enough and that integration of communication skills throughout the curriculum is better.

D. Specific component within a course

Some institutions have yet to find ways to integrate communication skills fully throughout their curriculum. Instead, they find success integrating one or two aspects into an already existing course, rather than creating an entire course devoted to the topic.

At Andrews University, technical writing and oral communication practice are integrated in the entire first year of engineering courses. Tasks include the writing of reports and giving of multiple presentations with feedback [10].

At Denison University, computer science and mathematics students focus on communication skills in their sophomore year. While enrolled in specific courses within their major, the two groups are brought together once a week for a lab. During the course of the term in this lab session, students presented three talks on topics in math or computer science which are peer reviewed by other students. They are also asked to self-critique their presentations and to critique talks outside the course (departmental talks or campus-wide talks). Survey results indicated that they are now more at ease presenting math or computer science material in front of an audience and have increased willingness to present their talks at the department, regional, or national level [11].

At Roger Williams University, they focused on enhancing oral communication skills by asking students to extemporaneously talk about a random topic for three minutes once a week. The talk stops at the end of three minutes or when the presenter uses a distractor ('um', 'ah', or long pauses without speech). Though these talks are not formally assessed, it is noted that there is improvement in student performance in presentations within other courses [12].

A multi-institutional effort was described in [13] for integrating communication skills into a data structures and algorithms class. This course was typically taught in the second year of the curriculum. Writing, speaking, reading, listening, and teaming were focused on through various assignments. Students were asked before and after to rate their ability in reading, writing, speaking, and teaming. Students rated themselves more positively at the end than at the beginning, but the authors do not indicate whether those increases are of statistical significance.

Bennett and Urness describe a CS1 course that used daily student presentations as a way to address communication skills at the introductory level [14]. Students select topics for these presentations, which allowed for greater coverage of breadth of computing topics than a typically programming-focused CS1 course. The presentations were only a few minutes in length and generally students provided interesting presentations. The authors studied student change in attitude toward computing, but not communication skills. Anecdotally, the instructors indicate that they see improvement in student's skills.

For a junior-level course in object-oriented programming at King's College, peer evaluated oral presentations have been added [15]. Michael observed that the student participation (in the peer evaluation process) made them more invested in the presentations as a whole. He notes, however, the interesting range of opinions (across the spectrum of positive and negative feedback) about certain presentations that were collected from the peer evaluation forms.

In [16], we see the use of a student-centered model with problem-based learning and peer assessment to tackle the problem of developing communication skills. The students developed writing skills through the use of wikis and oral presentation skills via poster presentations. The authors of the study report that students enjoyed the wiki assignments. The authors believe this is because they were not traditional writing assignments (e.g. reports). For the poster presentations, the authors discuss how they provided feedback and allowed students to improve by asking them to present multiple times, iterating on their ideas each time.

E. Assessment of communication skills

In [17], a focus group study was employed to look at engineering students beliefs about their learning of communication skills. While the focus group asked about communication in general, the participants focused on writing as the main form of communication in their responses. The participants in this study indicated that they learned communication skills better when they received more examples of good communication on which to model. They also indicated that they wanted examples grounded in the real world as to how communication would fit into their future.

III. OUR COURSE

In the School of Interactive Games and Media at Rochester Institute of Technology, all of the graduate students are required to enroll in the Game Development Processes course. This course has been focusing on aspects of communication as it directly relates to the art of game concept pitch process [18]. Development of communication skills is not a direct learning outcome of the course, but rather of our graduate program as a whole.

At first, we explored many of the approaches outlined in the previous section as a means to enhance communication skills throughout the course. However, we quickly noted that these techniques did not map well with the needs of the course. The pitch process is more than just communication, but instead lends itself more into the format of limited dialogue with an audience under constraints of time and succinct information presentation, all while adjusting to the needs of the audience. As such, prior discussed methods do not focus upon the richness of such a dialogue and do not address the nuances and adjustments needed as part of the practice of this format.

This course and its content lend itself to the inclusion of assignments that can potentially help to increase student comfort and ability with communication skills, but it is not the only place these skills are integrated. So our model for integrating communication skills maps most closely onto the models that integrate different aspects of communication skills within various courses.

While more details about the course can be found in [18], we will recap the structure of the course at it relates to communication and pitch and detail how the latest version of the course (Fall 2014) changed from the previous structure mentioned. The communication skills that this course is focused on increasing are oral communication skills (presentation, ideation, pitch, critique). In Fall 2014, the class met three times a week for fifty minutes each class period. Within the class, there were various group activities employed. The instructor for the course assigned the students to groups ensuring that through the semester, the students were required to work with as many of the other students as possible with minimal overlap.

A. Ice-Breaking and First Assignment

Within the first three weeks of the course, we provide the students with an overview of many aspects of the game industry through interactive experiences. In the third class of the semester, we discuss aspects of the industry as seen in the Entertainment Software Association's 2014 Industry Report [19]. To do this, we use a variation of the game Wits & Wagers [20] in which the students are divided into four teams that compete against each other. In the next class, we use a variant of Pictionary [21] to get students to describe to their classmates, through drawings on the board, the various roles one could have in the games industry. For class 7, the students are challenged to a competition using three unique games, a synonym-based word puzzle game (a "word rebus" where instead of pictures standing in for words, words stood in for other words), Taboo [22], and Charades [23]. These three are used to illustrate the various types of communication that are useful in at team setting: written, verbal, and non-verbal.

For each of these games, someone in the class is required to give clues or present in some fashion to the class. Then, the rest of the class must participate in some way if they want to get the answer and/or earn points for their team. From observations in the last several course offerings, including the Fall 2014 offering, the students were very eager to interact and the atmosphere in the room was light and fun. The students seemingly had a good time playing the games and interacting with their classmates.

Within the first two weeks, the first assignment for the course requires the students to complete a deliverable is assigned and collected. This assignment asks the students to forecast the future by looking at current trends in the field and putting together a presentation (a set of slides) about the trends that they find the most interesting, appealing, and/or promising. The slides are submitted to the faculty, but there is no presentation of the assignment. The grading for the assignment, however, is based on how well they expressed the trend through visual storytelling and minimal textual explanation. Slides that are "walls of text" are not sufficient for the exercise, and are not accepted as a deliverable.

At the beginning of class 6, the start of the third week of classes, several examples are pulled from the submitted assignments and critiqued as a group for aesthetics, ability to convey information, and ability to hold interest. Both strong and weak examples from student submissions are critiqued. At this stage in the course, the submissions are critiqued anonymously. We discuss as a group and through critique how the information was effectively or not effectively conveyed. We discuss ideas of how to convey information visually. As part of the critique process, the students are also taught techniques for critique. They learn how to separate out their personal biases from subjective analysis and learn how to present feedback in constructive ways.

B. Ideation and Presentation of Ideas

Starting in the fourth week of class, we move into the topic of ideation. Coming up with good ideas is not an easy task and if we want our students to succeed in a fast-paced industry, we need to make sure they have some techniques for rapid generation, exploration, and evaluation of novel ideas. We introduce them to three techniques during weeks four and five that will give them some tools for ideating in the future, blue sky [24], brainstorming [25], and mind mapping [26].

Each technique is given approximately two class periods broken up with the following structure: present the technique, students work in small groups and perform the technique, students informally present the ideas generated. For each of these techniques, it is helpful to "seed" the session with a theme or idea as well as a goal. We have had the instructor give a theme (thought about before class). We used the game Name 5 [27] to generate lists of "things" and choose from those lists to ideate around, and we have also used the Grow a Game website [28]. The goal is for the students to come up with a game idea.

After the students have been given the "seed" and performed the technique for a short time (10-25 minutes depending on the technique), the teams are instructed to focus on the best of the ideas generated and flesh out their group's game idea for 5 more minutes. After that time, one person tells the entire class what the game idea was and how the technique got them to that idea. During these informal presentations, we tell the other groups that questions are appropriate, positive comments are welcome, negative comments are not, and constructive suggestions are actually the best.

C. Pitch

After an idea is hatched, we need to form a cohesive game concept around it and present that concept to the stakeholders that will eventually decide if it will be moved into production as a game. This pitch process is one that we spend significant effort on during the class. The students are led through a series of discussions and lectures about what the important parts of a pitch are and what makes a good pitch [18]. Then, we ask them to perform the task of pitching, many times.

For the Fall 2014 semester, the students were first asked to pitch their ideas for their semester-long project to the course instructor. This was done during class 11. This pitch needed to be done early to facilitate the progress of the project and make sure students were on the right track early or risk an unsuccessful project by the end. These pitches were limited to 10 minutes in length. After the teams presented their pitch, there was a short time for questions from the audience. Feedback was then given to each team by the instructor about their project as well as their pitch.

In what would become a theme for the semester, they were told they were going to do it again for class 17. This time for only 8 minutes and that they would need to ensure all group members spoke, and that they would be presenting their ideas to another instructor who had not heard the first pitches. Therefore, they could not rely on previous knowledge of the audience. At least one person would have never heard about their game before, and that was the person that was ultimately grading them and giving them feedback on their second attempt.

A few weeks later (in class 24), the students were surprised with an in-class exercise in which they were asked to pitch another group's semester-long project. In what we call "minute-pitch swap" the groups were allowed 5 minutes to introduce the other group to the games and then 8 minutes to prepare a maximum 2-minute pitch about the other team's game. The purpose of the exercise is two-fold; first, it gets the original team talking about their project again, and second, it allows the other team to put their spin on the project and present it in a different way than the project's "owner". In some cases, this caused the groups to re-think or enhance certain aspects of their project based on what the other group found important and/or focused on for these short presentations.

On class 30, the groups were told that they would have to prepare another pitch for class 34 (in a little over a week). They were assigned groups and given 8 minutes to pitch a new game idea picking at least two elements from the following list of themes: gangsters, gardening, fire, turtles, an attic, and airplanes. After the pitches from class 34 were complete, the groups were instructed to go back and do the same pitch again for class 36 focusing on polish of the pitch.

The last pitch of the semester was in the form of the final project presentations. While not a pitch, per say, the students were instructed to treat it more like a longer, product pitch. The product was done, they were now selling it to their target audience and related stakeholders. Basically, we did not want them to perceive the final presentation like a presentation, but to keep the lessons learned from pitch as they described to us their final product.

D. Other Presentations

There were other presentations required of the students throughout the semester. Some presentations were more traditional. The semester-long project ended with a postmortem presentation in which the members of the group reflected back on what worked and what did not for their project and within their group structure and work patterns. The final for the course was a presentation on business and legal concerns as they relate to starting an independent game studio.

In the middle of the semester, groups were formed to present to the class about various software design methodologies (e.g. Scrum, Agile, Waterfall, etc.). For this presentation, the groups were tasked with creating an interactive exercise for the students as part of their presentation. This exercise was to be designed to illustrate the methodology that they were presenting to the class.

As you can see, we utilize a number of different techniques to encourage our students to communicate with each other in teams and to the class as a whole that are both formal and structured as well as casual and semi-structured. Throughout the semester, in conjunction with these activities, the students are asked questions by their peers and by their instructors. In other words, they participate in and are subject to critique of their ideas and presentations. As described in [18], the instructors feel that these exercises have a positive benefit to the students and their communication abilities. A question that remained unclear is whether or not the students felt any difference in their communication skills and abilities.

IV. METHODOLOGY

Due to the amount of focus on oral communication skills and the observation of the course instructors that by the end of

the course that students seemed to be better at communicating, we wondered whether or not the students perceived a difference in their comfort with their communication skills by the end of the semester. Our main research question was: For students enrolled in the Processes class, would there be an increase in comfort level with communication skills at the end of the semester when compared to the beginning of the semester?

In order to determine whether or not this was the case, we created a study that used a quantitative methodology that followed a quasi-experimental design approach [29]. The Comfort with Communication and Critique survey was created (Appendix). This 5-point Likert-scale survey, (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree), consisted of 23 statements. Within the survey, participants were asked their level of agreement with statements about their oral communication skills and ability to give and receive critique.

The survey was created with a mix of positively worded and negatively worded statements to avoid the problem of a student simply picking "5" for all statements. The same score for all statements does not make sense given the nature of the statements and therefore, any data with the same answer for all statements would be removed from the analysis.

This survey was administered at the beginning (during class 3) and at the end (at the final exam) of the Game Development Processes Course. It was delivered as a "quiz" through the university's learning management system. The quiz format was chosen because it provides a way to track the responses back to an individual student. The students were told that even though this survey was under the "Quiz" tab for the course, it was not a quiz, and was not a graded component for the course. Therefore, participation was voluntary.

In order to provide a contrast to the results from the Processes class, the same survey was administered during week 1 (class 3) and the final week of the semester to a class called Production Studio. The purpose of production studio is to allow upper-division undergraduate students a chance to work on projects of their choosing under the direction of a faculty member. In this course, there is not an emphasis on ideation, pitch, or process, and students were not exposed to the range of presentation and critique activities as they were in the Processes class. In fact, the students were expected to receive instruction in production processes in prior coursework, with the focus of the course being a simulation of the KickStarter process. Presentations and communications were critiqued by the instructor and by the class, and although there were recommendations for improvement, there is no learning outcome for this course for exploring process models directly.

As a secondary research question, we wanted to see that there was no difference in comfort level with communication skills in the Production Studio group.

After the two surveys were administered, the data was exported from the learning management system by the individual course instructors and the participant's survey from the beginning of the semester was paired with their survey from the end of the semester. Following the pairing,

information about which student completed which survey was removed. The data was saved in Microsoft Excel format and Analyse-It was used to analyze the results of both groups.

V. RESULTS

There were 15 students enrolled in the Game Development Processes course for the Fall 2014 semester. Of those 15, 14 completed both administrations of the survey, giving a response rate of 93%. For the remainder of this section, this group will be referred to as the experimental group.

There were 19 students enrolled in the Production Studio course in the Fall 2014 semester. All of the 19 students completed both administrations of the survey, giving a response rate of 100%. For the remainder of this section, this group will be referred to as the control group.

We will call the survey given at the beginning of the semester the pre-survey and the survey given at the end of the semester the post-survey. The mean for each statement for both the pre-survey and the post-survey is shown in Table 1, and is categorized by each statement. Results are shown for pre- and post- results by the control and experimental groups. A mapping of statement identifiers to the actual statement text is shown in the Appendix of this paper.

TABLE I.   SURVEY AVERAGES PER STATEMENT
(* INDICATES SIGNIFICANCE, P < 0.05)

| | Survey Average | | | |
| | Control Group (n=19) | | Experimental Group (n=14) | |
	Pre-Survey	Post-Survey	Pre-Survey	Post-Survey
S01	4.53	4.21	4.43	4.43
S02	2.42	2.84	2.57	2.43*
S03	3.89	4.00	4.57	4.64
S04	3.26	3.37	3.36	2.79
S05	3.37	3.53	3.86	4.21
S06	2.32	2.63	2.14	1.93*
S07	3.63	3.74	3.71	4.07
S08	4.16	3.89	4.36	4.50
S09	3.79	4.00	4.00	3.93
S10	4.37	4.16	4.00	4.07
S11	4.00	4.00	4.07	4.07
S12	4.16	4.16	3.79	4.14
S13	3.74	4.00	3.93	4.29
S14	3.37	3.53	3.71	4.00
S15	3.89	3.84	3.93	4.21
S16	3.74	3.84	3.36	3.36
S17	4.05	4.32	3.57	4.00
S18	2.37	2.63	2.14	2.00

	Survey Average			
	Control Group (n=19)		Experimental Group (n=14)	
	Pre-Survey	*Post-Survey*	*Pre-Survey*	*Post-Survey*
S19	3.89	4.21	3.86	4.00*
S20	3.89	4.16	3.79	3.86
S21	3.58	4.00	3.29	3.50*
S22	3.37	3.58	3.43	3.79
S23	3.16	3.37	2.79	3.14

A. Comparisons between pre-survey and post-survey results in experimental group

Our main research question was concerned with a difference in pre-survey to post-survey scores in the experimental group. We performed a pair-wise analysis of results by statement. Due to the low number of samples, we used the Wilcoxon rank-sum test for non-parametric analysis. For the experimental group, we did not find significant differences from pre-survey to post-survey responses.

B. Comparisons between pre-survey and post-survey results in the control group

Our second research question asked whether there was a difference in pre-survey to post-survey scores within the control group. Due to the same constraints as the first analysis, we used the Wilcoxon rank-sum test for non-parametric analysis.

For the control group, some of the statements revealed significant differences from pre-survey to post-survey results in statements related to speaking, critique, and mediation.

The first category where we notice some significant difference in score is in statements related to oral communication. Statement 2, "I feel unsure of myself when I speak to a person of authority (e.g. Professor, Boss)" demonstrated a significant difference between pre-survey and post-survey results ($W(7) = 0.0$, $p < .05$). Furthermore, statement 6, "I become less confident if someone asks a question during my formal presentation" showed significant difference between the surveys ($W(6) = 0.0$, $p < .05$).

For critique, statement 19 asked, "I feel confident in my ability to give useful critique of other's ideas". This statement also showed a significant difference between pre-survey and post-survey as well ($W(6) = 0.0$, $p < .05$).

Finally, for the category of mediation, statement 21, "I feel that through my writing, I can mediate problems or differences between team members" presented a significant difference in score ($W(7) = 0.0$, $p < .05$). The remainder of the statements did not demonstrate any significant difference.

VI. DISCUSSION

The results from the survey for our main research question were disappointing. There was not a statistically significant change in the responses of the students from the beginning to the end of the semester.

One possible explanation for this is the fact that the students were already fairly comfortable with their communication skills when they entered the course. The course is made up of graduate students. It is possible that they were exposed to activities before coming into the graduate program either in an undergraduate program or a professional setting that prepared them for communicated and they felt comfortable doing it.

Although we did not find statistically significant differences in responses, we did notice some trends that point to areas of further investigation, based upon confidence interval differences in individual statements between the pre- and post- survey [30, 31].

The statement where answers changed in the less desirable direction was statement 9, "I am confident in my ability to convey ideas orally", pre-survey mean was 4.0 and post survey mean was 3.93 showing a decrease in agreement of 0.07. While also not significant, it did cause us to ponder another question that would require further observation. We question as to whether prior to coming into the class, students may have been over-confident in their abilities in oral presentation and throughout the various activities, they realized that they were not as prepared as they had thought and it changed their views by the end of the semester.

A. Control Group

The results from the control group were surprising. We hypothesized that there would not be a change in the comfort level for the control group due to the lack of interventions and lack of focus on communication skills within their course. However, we did find statistically significant differences for some of their responses.

They became more confident in their ability to give critique (statement 19) and mediate problems or differences between team members in writing (statement 21). They became less confident in their ability to speak to a person of authority (statement 2) and in their ability to remain confident if someone asks a question during a formal presentation (statement 6).

We do not know why this is the case. As with the Processes class, the perspective of the instructor is that the students improved in their communication skills over the course of the semester. The fact that they had such a positive jump in their perceived ability to give critique and mediate differences through writing could be a side effect of the nature of the course which was project based and involved teams.

Their decreased confidence with regards to speaking to authority and being asked questions during a presentation is puzzling and there does not seem to be a reason given the course structure as to why this would be the case.

Looking at the non-statistically significant responses for this group, we see that for statements where the students should disagree more (4 and 18), they in fact, agree more. For statement 4 "I am not very confident when I perform in front of a large group of people", the pre-survey mean was 3.26 and the post-survey mean was 3.37, showing an increased agreement with this statement and a difference of 0.11. For statement 18,

"I cannot take criticism from others well", the pre-survey mean was 2.37 and the post-survey mean was 2.63, showing an increased agreement and a difference of 0.26.

We see the same "opposite" results for three of the statements where the students should agree. In statements 1, 8, and 10, their mean score for agreement dropped by the end of the semester. For statement 1 "I am confident when I speak one-on-one with a fellow classmate", the pre-survey mean was 4.53 and the post-survey mean was 4.21 showing a decrease in agreement by 0.32. For statement 8 "I am confident in my beliefs as I present my viewpoint", the pre-survey mean was 4.16 and the post-survey mean was 3.89 showing a decrease in agreement by 0.27. For statement 10 "I am confident in my ability to convey ideas in a written form", the pre-survey mean was 4.37 and the post-survey mean was 4.16 showing a decrease in agreement by 0.21.

Overall, it seems that this group became less confident of their communication abilities as the semester came to a close, but we don't have any explanations as to why this may have occurred.

VII. LIMITATIONS AND FUTURE WORK

Even though we tried to design this study with as much rigor as possible, we viewed this strictly as a first step and exploratory in nature. We wanted to more systematically investigate the impact the various interventions in the Processes course were having on the students comfort with communication. To that end, we created a new instrument that was administered to two groups of students. We are limited by the fact that the instrument is in fact new and had not been used before. We are also limited by the number of participants we had in the study. Further, the control group was not a complete control as there were aspects of the course that required them to use communication skills.

For the instrument, we need to work to ensure reliability and validity. This can only be done by administering the survey to more participants and we are actively working on ways in which this can be done both within the Processes course and outside.

For our Processes course, we did not receive the intended results we wanted from the study. We did not see a statistically significant increase in the student's comfort level with their communication skills. However, we have noted previously and again with the Fall 2014 semester offering, the instructor observation that the students' communication and presentation skills did improve throughout the semester. Therefore, our next step is to determine if our observations are flawed about the increased ability in communication skills, if our belief that this is partially caused by an increase in comfort with those skills is flawed, or if our instrument needs to be adjusted to better detect comfort with communication skills.

The surprising results came from what we considered our control group. For this group, it appears that their confidence in their communication abilities actually decreased during the semester. Nothing that was in the course or its expectations gives us an idea as to why this may have occurred. In order to determine why this may be occurring in this course, further investigations are needed.

APPENDIX
COMFORT WITH COMMUNICATION AND CRITIQUE SURVEY

1. I am confident when I speak one-on-one with a fellow classmate.
2. I feel unsure of myself when I speak to a person of authority (e.g. Professor, Boss).
3. I am confident when I speak to a casual gathering of friends (e.g. telling about my weekend plans).
4. I am not very confident when I perform in front of a large group of people (e.g. talent show, play, musical performance).
5. I am confident when I have to give a formal presentation to a group.
6. I become less confident if someone asks a question during my formal presentation.
7. I am confident I can express a given viewpoint that is not my own in a formal presentation.
8. I am confident in my beliefs as I present my viewpoint.
9. I am confident in my ability to convey ideas orally.
10. I am confident in my ability to convey ideas in a written form.
11. I am confident in my ability to convey ideas in an email.
12. I am confident in my ability to convey ideas in a formal document, design document, or written report.
13. I am confident in my ability to create an effective presentation (e.g. Powerpoint).
14. I am confident in my ability to create an engaging presentation (e.g. keep the audience interested).
15. I feel more comfortable telling someone my thoughts face to face.
16. I feel more comfortable telling someone my thoughts in written form (email, text, etc.).
17. I understand how to critique others.
18. I cannot take criticism from others well.
19. I feel confident in my ability to give useful critique of other's ideas.
20. I feel that I am able to mediate differences between different viewpoints.
21. I feel that through my writing, I can mediate problems or differences between team members.
22. I feel that I am capable of making a convincing presentation that can change someone's mind.
23. As people critique my presentation, I find myself swayed to their viewpoint.

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