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The Effect of In-Person versus Pre-recorded Final Presentations on Student Learning Outcomes and Engagement

Julie Leonard-Duke, University of Virginia

Julie Leonard-Duke is a current graduate student in Biomedical Engineering at UVA highly interested in engineering education research. During her undergraduate degree at Georgia Tech, Julie was involved with engineering education research in the Department of Biomedical Engineering and the Center for Academic Success. Additionally, Julie was named a University Innovation Fellow and through her training at the Stanford Design School designed a new undergraduate Biomedical Engineering course at Georgia Tech that was formally added to the curriculum in the Fall of 2019. Julie's research at UVA has focused on encouraging students to integrate technology with their learning.

Dr. Shayn Peirce-Cottler, California State University, Channel Islands

I am Professor of Biomedical Engineering at the University of Virginia. I have joint appointments in the Department of Plastic Surgery and the Department of Ophthalmology. I have deep interest in studying the structural and functional adaptations of tissu

Dr. Timothy E. Allen, University of Virginia

Dr. Timothy E. Allen is a Professor in the Department of Biomedical Engineering at the University of Virginia. He received a B.S.E. in Biomedical Engineering at Duke University and M.S. and Ph.D. degrees in Bioengineering at the University of California, San Diego. Dr. Allen's teaching activities include coordinating the undergraduate teaching labs and co-teaching the Capstone Design sequence in the BME department at the University of Virginia, and his research interests are in the fields of computational biology and bioinformatics. He is also interested in evaluating the pedagogical approaches optimal for teaching lab concepts and skills, computational modeling approaches, and professionalism within design classes. He is active within the Biomedical Engineering Division of the American Society for Engineering Education and previously served on the executive committee of this division (Program Chair 2011, Division Chair 2012, and Nominating Committee Chair 2013). Dr. Allen is the recipient of ten teaching awards at UVA, including the All-University Teaching Award in 2017. Since 2016, he has been the PI on an NSF REU site focused on multi-scale systems bioengineering and biomedical data sciences, a collaboration involving faculty in SEAS, SOM, SDS, and CLAS at UVA, as well as six partner institutions in the mid-Atlantic and Southeast.

The Effect of In-person versus Pre-recorded Final Presentations on Student Learning Outcomes and Engagement

Abstract

Pre-recorded presentations are becoming more prevalent in professional settings, such as conferences and in the classroom, and require a different but related skill-set than the standard in-person presentation. To evaluate student performance and understanding of pre-recorded versus in-person presentations we conducted a preliminary research study in a Systems Bioengineering course with a mixture of undergraduate and graduate enrollment. For each of the four course modules, students were randomly assigned groups with at least two graduate students per group and developed a small computational model based on the module's topic. Students presented their work in a pre-recorded presentation in the first and third modules and in an in-person presentation in the second and fourth modules. At the end of the course, students were asked to complete an anonymous Qualtrics survey, developed based on previous surveys that evaluated in-person versus virtual presentation formats[1, 2], to identify the positives and negatives associated with pre-recorded presentation on both the presenter and the audience member. Nine students, eight graduate students, and one undergraduate student completed the survey. All students had prior experience with in-person presentations, but only two students had previous experience with pre-recorded presentations. Students rated how delivering presentations in each presentation style impacted a variety of learning outcomes, such as ability to be innovative and take risks, improving teamwork skills, and improving communication skills, on a scale of 1 to 10—with 1 being no impact and 10 being great

impact. In general, across all categories delivering in-person presentations were rated higher than delivering pre-recorded presentations, with an average mean score of 7.91±1.92 versus 4.24±2.94. Similar trends were seen in the results for audience learning for in-person versus pre-recorded presentations. Learning objectives assessed for being an audience member during each presentation style included understanding of the project presented, ability to think critically about the project, willingness to ask questions, and understanding of the overall module. Across all audience learning categories, in-person presentation scores averaged 7.5±1.66 while pre-recorded presentations again scored lower, but with large standard deviations, at 3.83±3.16. Students were also asked two short answer questions on which presentation medium they would pick in the future and challenges they faced when making the different types of presentations. While the majority of students indicated a preference for in-person presentations, two students preferred pre-recorded presentations, stating that pre-recorded presentations "[L]ets you be sure to articulate clearly with multiple attempts" and "Although it took more time and was harder to gather everyone for the pre-recorded presentations let me think about the other groups presenting instead of going over information I would have to present when it was my groups turn." Overall, students indicated a strong preference for in-person presentations that was independent of anxiety levels.

Introduction

  Pre-recorded presentations are becoming more prevalent in professional settings, such as conferences and in the classroom, and require a different but related skill-set than the standard in-person presentation. The use of recorded lectures in the classroom has been discussed and had varying degrees of success since the early 2000s [1-3]. In the past decade the use of virtual formats for conferences has been more prevalent, with the Covid-19 pandemic pushing virtual conferences into the mainstream. Ongoing pandemic concerns, combined with increased awareness of the effect of conference travel on climate change and the challenges for including groups from countries where travel out of the country may be difficult, mean that virtual conferences and presentations are going to continue to happen in some capacity[4]. In the post-pandemic age, pre-recorded scientific presentations have become more commonplace, including at biomedical engineering related conferences, including the Biomedical Engineering Society Annual Conference. Presenting virtually and preparing pre-recoded presentations requires a different skill set than in-person presentations, and therefore educators should consider implementing them in the classroom to help students develop these skills early on.

  Additionally, pre-recorded presentations allow the student to reflect on and self-assess their presentation skills by watching the presentation after they have given it. They can reflect both on how they perceived the presentation went, while they were delivering it and after watching the recording. This approach has previously been proposed as a useful learning tool to help students become more aware while presenting and improve their presentation skills [5].

  To evaluate student performance and understanding of pre-recorded versus in-person presentations, we conducted a preliminary research study in a Systems Bioengineering course with a mixture of undergraduate and graduate enrollment. The course was divided into four modules that focus on each modeling topic covered in the

course – agent-based modeling for multicellular relationships, ordinary differential equations for signaling networks, flux balances analysis for metabolic networks, and statistical methods for informing model selection. For each of the four course modules, students were randomly assigned to groups and developed a small computational model based on the module's topic. Students presented their work in a pre-recorded presentation in the first and third modules and in an in-person presentation in the second and fourth modules. At the end of the course, students were asked to complete an anonymous Qualtrics survey, developed based on previous surveys that evaluated in-person versus virtual presentation formats[6, 7], to identify the positives and negatives associated with pre-recorded presentations on both the presenter and the audience member. We hypothesized that there would be no significant differences in student understanding of course material or presentation skills as a presenter or audience member between the two presenting methods.

Course Description and Assessments

The Biomedical Engineering (BME) 4315/6315 Systems Bioengineering course was taught in-person during the Spring 2022 semester and course enrollment was a mixture of undergraduate and graduate students. This course introduces techniques for constructing mathematical and computational models of biological processes and utilizing experimental data to validate those models at many levels of organizational scale — from genome to whole-tissue[8]. Students attend lectures, read literature, and participate in discussions focused on various modeling and experimental validation techniques. Students also work in teams to complete group modeling projects that apply specific modeling techniques. In addition to obtaining hands-on experience with regards to the modeling portion of the course, teams also work with raw experimental data relevant to the biological question of each module. Topics that are covered include choice of modeling techniques appropriate to addressing particular biological problems at different scales, quantitative characterization of biological properties, assumptions and model simplification, parameter estimation and sensitivity analysis, model verification and validation, and integration of computational modeling with experimental approaches.

Team formation
For each of the four course modules, twenty-seven students were randomly assigned six groups with at least two graduate students per group and a maximum group size of five students per group. The average group size was 4.32 students.

Presentation guidelines
Each module every team gave two presentations. The first was called the "pre-presentation" and was always delivered in-person. The second was the "final presentation," and the format of this presentation alternated each module between pre-recorded and in-person. The pre-presentations were not graded and were mainly for the students to receive feedback on their proposed project for the module. The final presentations were graded according to the following rubrics on a 10-point scale:
- Organization
- Clarity

- Inclusion of specific criteria laid out in class (i.e. description of model assumptions, source of biological data, etc.)
- Team's understanding of how to implement the modeling technique covered that module
- Team's understanding of the limitations of the modeling technique covered that module.

The presentations were eight minutes in length followed by two minutes of questions regardless of presentation format. For each module either the pre-recorded presentations were played or the in-person presentations were given and then both were followed by a live question and answer session.

Student assessment of learning

All studies were conducted according to the guidelines of the UVA Institutional Review Board for Social & Behavioral Sciences under the approved Protocol #4931. Our goal was to identify the positives and negatives associated with pre-recorded presentations on both the presenter and the audience member. The survey was administered after the Spring 2022 semester. The survey was anonymous and was administered using Qualtrics after grades were finalized. The survey contained five sections where students self-reflected on their presentation experiences, as well as their experiences as audience members, by rating statements on the Likert scale. The fifth section of the survey contained two open ended questions to permit students to expand on their answers. Full survey is included in the Supplement.
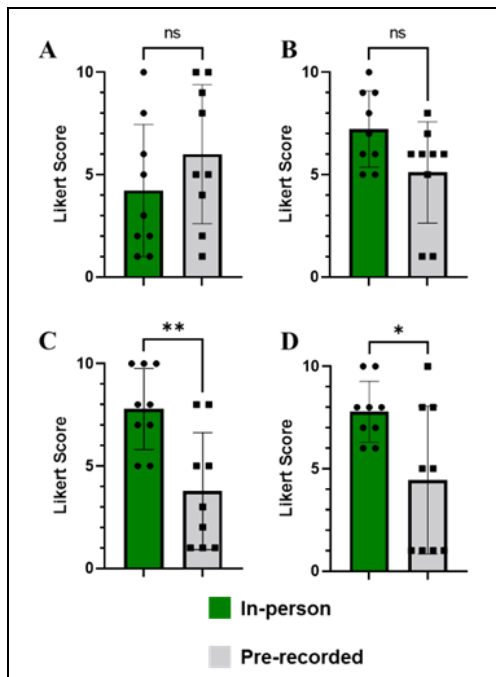
Statistical analysis

For comparisons between only in-person and pre-recorded presentations, Student's t-tests were used for statistical analysis with a statistical significance asserted at p values < 0.5. One-way ANOVA with Tukey's post-hoc test was used to compare questions where results for "In-person", "Pre-recorded", or "Mode Had No Effect" were compared. All data are presented as average +/- standard deviation.
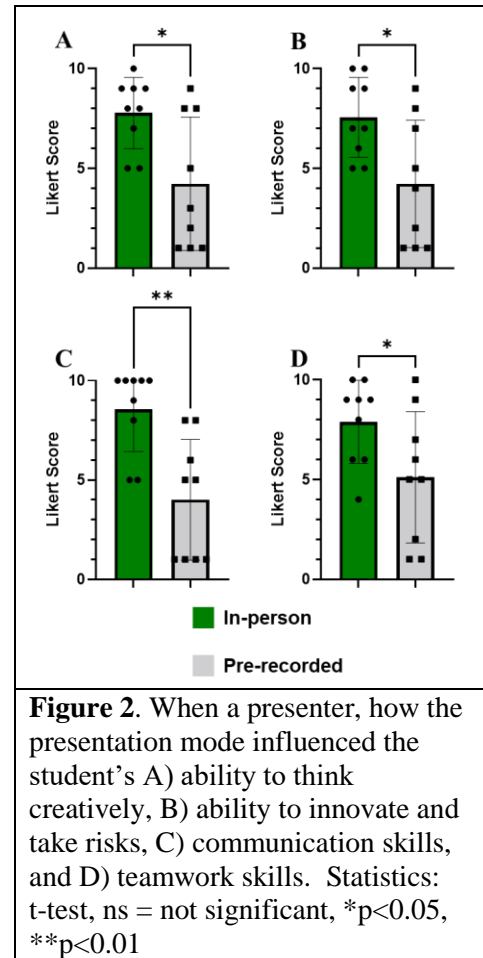
Results and Discussion

Nine students, including eight graduate students and one undergraduate student completed the survey. All respondents had prior experience with in-person presentations, but only two students had previous experience with pre-recorded presentations. Students rated how delivering presentations in each presentation

Figure 1. How the presentation mode affected the student's A) Anxiety as a presenter B) Improve presentation skills for presentation type C) Understanding of module as a presenter D) Understanding of module as an audience member. Statistics: t-test, ns = not significant, *p<0.05, **p<0.01
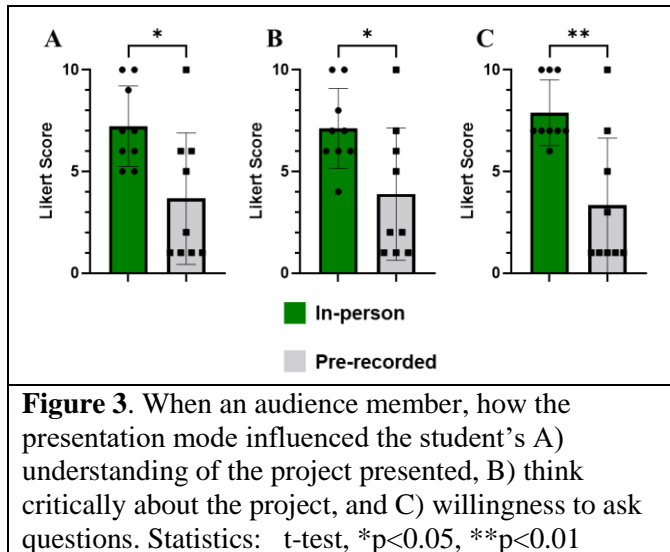
style impacted a variety of learning outcomes, such as the ability to be innovative and take risks, improved teamwork skills, and improved communication skills, on a scale of 1 to 10—
with 1 being no impact and 10 being great impact. There was no significant difference in student anxiety levels when completing in-person versus pre-recorded presentations (**Fig. 1A**) and there was no significant difference between how students reported their presentation skills (**Fig. 1B**). Their understanding of the module, however, was significantly impacted by presentation mode, and students responded that in-person presentations had significantly more
impact on their understanding, as both a presenter (**Fig. 1C**) and an audience member (**Fig. 1D**).

To further explore this medium dependent breakdown on understanding from a presenter perspective, we asked students to score how the presentation mode affected their growth in four key areas: 1) ability to think creatively (**Fig. 2A**), 2) ability to innovate and take risks (**Fig. 2B**), 3) communication skills (**Fig. 2C**), and 4) teamwork skills (**Fig. 2D**). In general, across all categories delivering in-person presentations were rated higher than delivering pre-recorded presentations, with an average mean score of 7.91 ± 1.92 versus 4.24 ± 2.94. These differences in scores

Figure 2. When a presenter, how the presentation mode influenced the student's A) ability to think creatively, B) ability to innovate and take risks, C) communication skills, and D) teamwork skills. Statistics: t-test, ns = not significant, *$p<0.05$, **$p<0.01$

were significantly higher in all four categories, with growth in communication skills being the most significant difference ($p < 0.01$). Additionally, the averages for all of these categories for the pre-recorded presentations was a 5.1 or lower indicating that the use of pre-recorded presentations had at best a "moderate" impact on student growth in these skill areas.
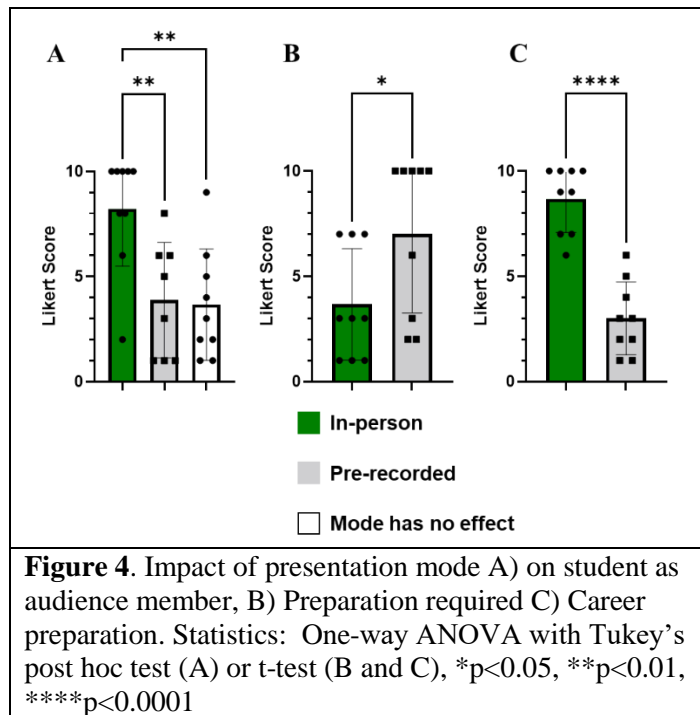
Figure 3. When an audience member, how the presentation mode influenced the student's A) understanding of the project presented, B) think critically about the project, and C) willingness to ask questions. Statistics: t-test, *$p<0.05$, **$p<0.01$

Students were also asked to reflect on how each presentation mode affected their understanding of the projects presented and their engagement as audience members. Across all audience learning categories, in-person presentation scores averaged 7.5 ± 1.66 while pre-recorded presentations again scored lower, but with large standard deviations, at 3.83 ± 3.16. Similar to the scores for understanding the overall module from **Figure 1**, presentation

medium also significantly impacted student understanding of individual presentations with in-person presentations scoring significantly higher than pre-recorded presentations (**Fig. 3A**). When evaluating metrics for engagement such as ability to think critically about the project (**Fig. 3B**) and willingness to ask questions (**Fig. 3C**), the use of pre-recorded presentations again scored significantly lower for impact on students than in-person presentations. There were students, however, that expressed support for pre-recorded presentations in their short responses with one student stating that "Although it took more time and was harder to gather everyone for the pre-recorded presentations let me think about the other groups presenting instead of going over information I would have to present when it was my groups turn."

Lastly, we looked at several metrics of how students valued the experience of using the different presentation modes. Results demonstrated that students felt that in-person presentations had significantly more impact on them as an audience member and that the mode of presentation was a significant factor (**Fig. 4A**). When evaluating time input required versus perceived long-term impact students responded that pre-recorded presentations required significantly more time (**Fig. 4B**, $p<0.05$) to complete but that in-person presentations were significantly more valuable for career preparation (**Fig. 4C**, $p < 0.0001$). In the future, a more detailed rationale and justification for the use of pre-recorded presentations should be provided at the start of the course, in addition to some examples of how pre-recorded presentations are used professionally, such as at society meetings.

Figure 4. Impact of presentation mode A) on student as audience member, B) Preparation required C) Career preparation. Statistics: One-way ANOVA with Tukey's post hoc test (A) or t-test (B and C), *$p<0.05$, **$p<0.01$, ****$p<0.0001$

The short answer responses provided some insight into the students' numerical responses especially when evaluating the utility of pre-recorded presentations. One student stated the benefit of pre-recorded presentations is that pre-recording a presentation "[L]ets you be sure to articulate clearly with multiple attempts," but on the contrary another student said that "there is an implicit pressure with pre-recorded presentations to continue to re-record until the presentation is perfect." Several students identified that additional time needed to edit the pre-recorded presentations added stress to the project, so in the future if pre-recorded presentations were used again it would be helpful to provide a short workshop on best practices for editing pre-recorded videos. Additionally, although pre-recorded presentations were not penalized for minor errors, some students perceived that they might be, and this perception created additional

anxiety. Explicitly stating in the presentation rubric that minor errors, such as mispronunciations, would not be penalized could relieve student stress around recording the "perfect" presentation. Additionally, for every module, regardless of final presentation mode, students gave a short in-person preliminary presentation describing their plans for their project before beginning working on the actual code. In the short answer, one student noted that they preferred to have the final presentation be pre-recorded and the preliminary presentation be in-person in order to practice presentation skills for both but being able to pay better attention to other groups' final presentations in class rather than practicing their own before delivering it.

Conclusions and Future Directions

In conclusion, students indicated a strong preference for in-person presentations over pre-recorded presentations, and this was not due to differences in anxiety using these different modes. Student understanding and learning outcomes for both the presenters and the audience members were significantly higher for in-person presentations. Although it was not possible with the number of student responses in this course (one undergraduate student and eight graduate students), in the future it would be interesting to see if some of these results are driven by degree program level or experience with different presentation types, as only two students had previous experience with pre-recorded presentations.

References

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Supplementary Material

Survey Questions for The Effect of In-person versus Pre-recorded Final Presentations on Student Learning Outcomes and Engagement

Section 1: Background Information
Please respond to the following questions to the best of your ability.

Q1 Which degree program were you enrolled in during the BME 4315/6315 course?
Q2 Before this class, did you have prior experience with in-person presentations?
Q3 Before this class, did you have prior experience with pre-recorded presentations?

Section 2: Reflection on Delivering Presentations
Please respond to the following questions to the best of your ability.

Q4 Please answer the following questions pertaining to in-person presentations (Module 2 & 4) and rate your response using the following scale:
 0 = no impact, 2 = slight impact, 5 =moderate impact, 8 = significant impact, 10 = great impact

To what degree did delivering an in-person presentation…

	1	2	3	4	5	6	7	8	9	10
allow you to think creatively?	○	○	○	○	○	○	○	○	○	○
allow you to be innovative and take risks?	○	○	○	○	○	○	○	○	○	○
improve your teamwork skills?	○	○	○	○	○	○	○	○	○	○
increase your self-confidence?	○	○	○	○	○	○	○	○	○	○
improve your communication skills?	○	○	○	○	○	○	○	○	○	○
affect your understanding of the module?	○	○	○	○	○	○	○	○	○	○

Q5 Please answer the following questions pertaining to pre-recorded presentations
(Module 1 & 3) and rate your response using the following scale:
0 = no impact, 2 = slight impact, 5 =moderate impact, 8 = significant impact, 10 = great impact

To what degree did delivering a pre-recorded presentation…

	1	2	3	4	5	6	7	8	9	10
allow you to think creatively?	○	○	○	○	○	○	○	○	○	○
allow you to be innovative and take risks?	○	○	○	○	○	○	○	○	○	○
improve your teamwork skills?	○	○	○	○	○	○	○	○	○	○
increase your self-confidence?	○	○	○	○	○	○	○	○	○	○
improve your communication skills?	○	○	○	○	○	○	○	○	○	○
affect your understanding of the module?	○	○	○	○	○	○	○	○	○	○

Section 3: Reflection on Listening to Presentations
Please respond to the following questions to the best of your ability.

Q6 Please answer the following questions pertaining to in-person presentations
(Module 2 & 4) and rate your response using the following scale:
0 = no impact, 2 = slight impact, 5 =moderate impact, 8 = significant impact, 10 = great impact

To what degree did listening to an in-person presentation…

	1	2	3	4	5	6	7	8	9	10
understanding of the project presented?	○	○	○	○	○	○	○	○	○	○
ability to think critically about the project?	○	○	○	○	○	○	○	○	○	○
willingness to ask questions?	○	○	○	○	○	○	○	○	○	○
affect your understanding of the module?	○	○	○	○	○	○	○	○	○	○

Q7 Please answer the following questions pertaining to pre-recorded presentations
(Module 1 & 3) and rate your response using the following scale:
0 = no impact, 2 = slight impact, 5 =moderate impact, 8 = significant impact, 10 = great impact

To what degree did listening to a pre-recorded presentation…

	1	2	3	4	5	6	7	8	9	10
understanding of the project presented?	○	○	○	○	○	○	○	○	○	○
ability to think critically about the project?	○	○	○	○	○	○	○	○	○	○
willingness to ask questions?	○	○	○	○	○	○	○	○	○	○
affect your understanding of the module?	○	○	○	○	○	○	○	○	○	○

Section 4: Comparison of Pre-Recorded versus In-Person Presentations
Please respond to the following questions to the best of your ability.

Q8 Please answer the following questions and rate your response using the following scale:
 0 = strongly disagree, 2 = disagree, 5 =neutral, 8 = agree, 10 = strongly agree

	1	2	3	4	5	6	7	8	9	10
I enjoy using technology for learning	○	○	○	○	○	○	○	○	○	○
I am confident using technology for learning	○	○	○	○	○	○	○	○	○	○
Modules 2 & 4 enhanced my skills with in-person presentation techniques	○	○	○	○	○	○	○	○	○	○
Modules 1 & 3 enhanced my skills with pre-recorded presentation techniques	○	○	○	○	○	○	○	○	○	○
In-person presentations made a greater impact on me as an audience member than pre-recorded presentations	○	○	○	○	○	○	○	○	○	○
Pre-recorded presentations made a greater impact on me as an audience member than in-person presentations	○	○	○	○	○	○	○	○	○	○
The impact of a presentation on me is not dependent on its mode	○	○	○	○	○	○	○	○	○	○

Presenting my team's work in an in-person format made me anxious	○	○	○	○	○	○	○	○	○	○
Presenting my team's work in a pre-recorded format made me anxious	○	○	○	○	○	○	○	○	○	○
In-person presentations required more preparation than pre-recorded presentations	○	○	○	○	○	○	○	○	○	○
Pre-recorded presentations required more preparation than in-person presentations	○	○	○	○	○	○	○	○	○	○
In-person presentations would effectively prepare me for communication tasks in a future career	○	○	○	○	○	○	○	○	○	○
Pre-recorded presentations would effectively prepare me for communication tasks in a future career	○	○	○	○	○	○	○	○	○	○

Section 5: Open-ended Questions
Please respond to the following questions to the best of your ability.

Q9 Given a choice, which presentation mode would you chose in the future? Why?
Q10 What are some challenges you faced in each presentation mode?