

PeerPresents: A Web-Based System for In-Class Peer Feedback during Student Presentations

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ABSTRACT

Peer feedback systems enable students to get feedback without substantially burdening the instructor. However, current systems typically ask students to provide feedback after class; this introduces challenges for ensuring relevant, timely, diverse, and sufficient amounts of feedback, and reduces time available for student reflection. This paper explores the current landscape of peer feedback tools and introduces a novel system for in-class peer review called *PeerPresents* where students can quickly exchange feedback on projects without being burdened by additional work outside of class. Through an exploratory study with Google docs and a preliminary evaluation of PeerPresents, we find students can receive immediate, copious, and diverse peer feedback through a structured in-class activity. Students also described the feedback they received as helpful and reported that they gave more feedback than without using the system. These early results demonstrate the potential benefits of in-class peer feedback systems.

Author Keywords

Peer feedback; feedback systems; collaborative learning; classroom technology.

ACM Classification Keywords

K.3.1. Computer Uses in Education: Collaborative Learning; H.5.3 Group and Organization Interfaces: Computer-supported cooperative work.

INTRODUCTION

Giving and receiving feedback is a key activity for student learning, especially in open-ended domains like design and writing [3,7]. As demand for education in such domains increases, instructors increasingly turn to peer feedback

systems to ensure students get personalized input on their work [7,17,27]. Peer feedback has been shown to improve learning by helping feedback receivers make connections between evaluation rubrics and their own work [29]; the activity also benefits the provider by helping them think critically about the evaluation criteria [9]. For mid-size to large classes, peer feedback can potentially increase the amount of feedback and shorten the amount of time to receive feedback, compared to receiving feedback from the instructor alone (e.g. [17]).

While peer feedback systems have helped address the increasing demand for feedback, the features and practices emerging around such systems can create new challenges for feedback providers. Many systems require peers to review a minimum number of other students' submissions, typically outside of class (e.g. [7]). In this arrangement, students often perceive peer reviews as an extra assignment [17], rather than as a learning opportunity. The PeerStudio project empirically demonstrated the value of rapid peer feedback [17], but students still need to schedule the feedback process around other commitments and may not be able to do the task quickly. To minimize workload, students typically only need to review the work of a few peers. Feedback receivers, therefore, only benefit from a small number of perspectives on their work, and those perspectives may vary widely in terms of quality and appropriateness [21]. The high variability and low diversity could be improved if a larger number of peers provided feedback. However, with current peer feedback systems, this would create an even larger burden on providers and limit the students' time to reflect on their own work.

Our work explores the possibility of moving peer feedback processes into the classroom. By pairing this process with student presentations, peers have a chance to comment on other students' work during class. This means students receive feedback by the end of class, potentially leaving more time to reflect. Also, by engaging the entire class, we hypothesize students will get more abundant and diverse feedback. Finally, past studies indicate that many students spend class time on non-learning activities, such as checking Facebook [16]. The intuition here is that in-class peer

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feedback can potentially supplant these off-task activities with ones that are beneficial for all students.

In this paper, we review prior work on peer feedback, as well as systems designed to facilitate peer feedback and audience interaction. We conducted an exploratory study where 53 students provided in-class peer feedback using shared Google Docs on student presentations in a project-based innovation course. This study demonstrated that in-class peer feedback could be successful, but that students need better support for reflecting on their feedback.

Based on these insights, we designed and developed a novel web-based, in-class peer feedback tool called *PeerPresents*. With this system, either students or faculty can design a rubric to guide the feedback process. Students can quickly access and participate on the system using any Web browser. Peers respond to rubric questions during and after the presentation, as well as vote on the responses from other students. Immediately after class, the students can see their feedback and use *PeerPresents* to organize and reflect on the help they have received.

As a preliminary evaluation of our novel tool, fifteen feedback providers used *PeerPresents* during practice research talks for six PhD students. The preliminary study demonstrated the value of structuring in-class peer feedback, and revealed further insights into how to elicit valuable peer feedback. In the discussion, we draw out implications for designing in-class peer feedback tools.

This paper presents the following contributions: 1) a taxonomy of existing peer feedback tools, 2) an exploratory study of an in-class peer feedback process using an off-the-shelf tool (Google docs), 3) a novel system called *PeerPresents* designed for in-class peer feedback, 4) a preliminary evaluation of the new feedback tool, and 5) reflections on lessons learned for in-class peer feedback exercises.

RELATED WORK

Numerous researchers have studied the benefits of peer feedback for all three parties involved: instructors, feedback receivers, and feedback providers. Peer feedback lowers the burden for instructors to generate feedback for the whole class. Students who receive feedback improve their self-regulated learning skills through the process of reflecting on feedback and revising their work [5]. Students who provide feedback learn to recognize what “good” work looks like and to correctly interpret standards or criteria [23]. Peer feedback also helps students improve their self-assessment abilities [19].

Qualities of Successful Feedback

Regardless of whether feedback comes from instructors, peers, or external reviewers, researchers have identified several key conditions that make feedback more successful for learning.

- *Relevant*: Feedback should focus on students’ learning and performance, rather than on the students them-

selves or their personal characteristics [13]. Relevant feedback helps students understand the desired criteria (conceptual), compare their actual performance with these criteria (specific), and engage in action that closes this gap (actionable) [26].

- *Copious*: Researchers and educators value the peer feedback process because it allows students to get a higher quantity of feedback than if the instructor were the only feedback provider [28]. Generating sufficient feedback has most often been limited by the instructors’ or peers’ time constraints.
- *Timely*: Feedback should be timely, such that students receive it soon after they submit their work. A recent study on a peer feedback system for large online classes found that peer feedback helped students improve their grades, but only if the feedback was delivered within 24 hours [17].
- *Diverse*: Seeking diverse feedback helps in many domains, especially in design settings that need to account for multiple stakeholders [3]. Diverse feedback providers are more likely to offer novel perspectives and uncover unique issues [20].
- *Reflected On*: Reflecting on feedback helps students become better self-regulated learners [5,19,23]. Reflecting on feedback requires students to manage their own learning by interpreting standards and rubrics and revising their own work.

Certain structural features of current peer feedback systems create challenges to achieving all these goals. Peer feedback systems are typically designed for use outside of class, and often require students to provide feedback to a certain number of other students. This places a burden on students, reduces the likelihood that students will receive feedback in a timely manner, limits the number of perspectives represented in a student’s feedback, and reduces the time available to work and reflect on their own assignment. Our research seeks to address these issues by introducing a system specifically designed for in-class feedback.

Design Considerations for In-Class Feedback

A number of additional factors come into play when considering in-class activities that could impact the design of peer feedback systems.

Time

There is limited time in any class session. Students and instructors may feel overwhelmed with adding another time-consuming activity to the class session [9], so implementing the in-class peer feedback system needs to be simple and time-efficient.

Management Logistics

Setting up and implementing a peer feedback process requires the instructor to manage numerous details, such as assigning peer reviewers or authoring rubrics. The instructor also might also need to evaluate both the original assignment and peer feedback itself in order to provide a grade [19]. (Numerous researchers also explore peer as-

assessment, where a student assigns another student a numerical grade on their assignment [e.g. [10]]; however, this paper focuses on qualitative peer feedback, not peer assessment.)

Risks for Students

Peer feedback requires students to make their work public, inviting potential risks such as loss of privacy, saving face, embarrassment, or even humiliation [19]. One indication that students are aware of these risks could be their reluctance to criticize peers when providing feedback [21].

Classroom Culture

Some researchers argue that peer feedback processes can only be carried out effectively when students understand the benefits of peer feedback, trust their peers, and benefit from an established collaborative learning climate [19]. Others point out the necessity for a non-threatening, collaborative atmosphere for peer feedback [24]. The instructor plays an important role in establishing a classroom culture that builds trust among peers and encourages learning without reducing learners' self-efficacy.

Attitudes Toward Technology Use

Most systems for peer feedback rely on digital technology to facilitate interaction, but instructors have a variety of attitudes towards using technology in class. While some instructors find technology beneficial to student learning [22], others decline to use technology in their class because of a lack of technical support or suitable software [4].

REVIEW OF EXISTING SYSTEMS

To understand the current state of peer feedback technology, we first investigated the successes and pitfalls of existing tools. We reviewed 31 different tools designed to capture qualitative feedback on student assignments, as well as tools designed to elicit responses from students during class or for general audience interactions (see Figure 1).

We discovered systems to review by following citation trails, searching academic and non-academic databases, and getting suggestions from experts. These systems supported activities such as peer feedback, student or instructor critique, facilitating discussion, answering questions during lecture, asking questions during lecture, and polling large

groups. We compared the systems using a competitive analysis. Rather than presenting all 31 systems, we chose to summarize the systems most influential to the design of a system for in-class peer feedback.

Feedback Systems

Most peer feedback systems are specifically designed for students to provide feedback outside of class [7,12,17,27]. We found one system designed for use during class [8], but this system—used to encourage novice group critique in a design course—also asked students to provide written feedback before the in-class critique session.

The peer review process is commonly characterized by a required number of reviews for each student [7,17], structured rubrics authored by the instructor to guide feedback [27], and a revision period before the final deadline [7]. In the case of PeerStudio, which facilitates rapid peer feedback to students in MOOCs, survey responses indicated that many students felt their schedule was too busy to revise. One student complained about the workload, saying that “(the instructors) expect us to read some forty page essays, then write the critiques and then review two other people, and then make changes on our work... twice a week” [17].

While some systems permit resubmission of assignments [7], reflecting on feedback was a task often ignored by peer feedback systems. Some provided only a way for students to view the feedback they received [12] without any additional support for sensemaking or reflection. One tool provided a leaderboard that allows students to see how their work ranked compared to classmates [27], but no support for understanding the reasons for their ranking. Even systems that allowed students to enter reflections on the feedback they received found that students rarely used this feature. For example, PeerStudio researchers found that only 100 out of 3600 students wrote reflections using the system [17].

Student/Audience Interaction Systems

To investigate the potential of in-class peer feedback, we reviewed tools designed for collecting input in real time during class. A number of systems support responses to pre-authored multiple-choice questions (e.g. [30]), and some require specific hardware [11].

In-class systems focused on being easy to use and often featured automatic real-time visualizations of student responses. For example, one system allowed students to ask questions during class and used voting as a way to highlight the most popular questions for the instructor [25].

We also reviewed systems designed to poll audiences who were not necessarily students in a classroom. Many systems were similar to in-class response systems in that they supported only multiple-choice responses and visualized responses in real time. Rather than relying on specific hardware like i>Clickers, these tools are often web-based and can be accessed via laptop or mobile devices. For example, Feedbackr, a tool designed to poll audiences

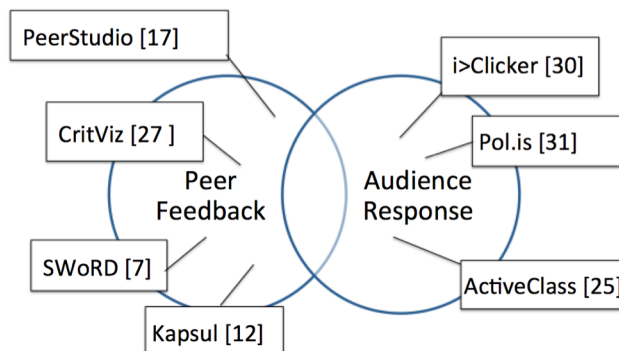


Figure 1. PeerPresents explores the intersection between peer feedback systems and audience interaction technology.

	In Class Use	Rubrics/ Scaffolding	Anonymous/ Pseudonymous	Voluntary Participation	Voting on Feedback	Reflection
Peer Feedback Tools						
Audience Response Systems	x			x	x	
CritViz [27]		x	x			
SWoRD [7]		x	x			
PeerStudio [17]		x	x			x
CSGC [8]	x	x			x	
PeerPresents	x	x	x	x	x	x

Figure 2. Features of existing peer feedback tools compared to PeerPresents.

during presentations, directs users to a short URL to view multiple choice questions, and the presenter can choose when each question is visible to audience members [14]. These tools commonly solicited anonymous responses from audience members.

Other systems designed to poll audiences went beyond multiple-choice questions. For example, Pol.is is a web-based polling system that uses machine learning and data visualizations to host large-scale discussions [31]. Once a topic has been created, Pol.is allows users to write a response or react (agree or disagree) to the responses of others. Then the system organizes users into groups who share similar opinions. These groups are visualized so that users can see whose thoughts align with their own and which reactions are most important to that group [31].

Lessons Learned from Other Systems

Our review of existing systems did not find any tools that focused both on peer feedback and real-time use during class. Existing peer feedback systems require extensive out-of-class time from students and may not promote or allow time for reflection, while existing in-class systems are typically limited to narrow types of interaction. However, both types of tools provide insights for the design of in-class peer feedback systems.

To encourage relevant feedback, we use scaffolding to guide the feedback process. To promote copious, timely, and diverse feedback, we bring the peer feedback process into the classroom. This allows students to receive feedback from potentially all peers by the end of class without requiring students to review a particular number of assignments or spend extra time outside class. We also implemented features to lower the risks for students to participate during class. Finally, we use student voting to highlight important comments to encourage presenters to reflect on their feedback. We developed additional constraints by examining how in-class systems were designed specifically for the classroom context.

Beyond the idea of facilitating peer feedback in-class, our system incorporates a number of novel features: question scaffolding, pseudonymous or anonymous participation, voluntary participation, voting, and reflection support. Figure 2 highlights the novelty of PeerPresents compared to existing peer feedback tools that influenced our system. We first discuss an exploratory study that proposes a process for in-class peer feedback using Google docs. We then

discuss the novel design of PeerPresents and the preliminary evaluation of our system.

EXPLORATORY STUDY

As an exploratory study of the procedures and design issues for exchanging in-class feedback, we decided to create a "prototype" using off-the-shelf technology (Google Docs).

Method

We conducted an exploratory study with 53 students (35 female) in a project-based innovation course focused on the design of mobile service applications. The course, offered at a mid-western university, was comprised of undergraduate (37) and graduate (23) students; 95 percent of students regularly carried a laptop with them to class.

Students provided feedback to their peers during mid-term presentations on a group assignment. During two class sessions lasting two hours each, nine groups of students presented their business model ideas for a novel mobile app, such as Friendr, an app to help you find a friend to attend events with you, and SunnySideUp, an app for requesting breakfast delivery to your office or home.

To enable peer feedback, each presenting group prepared a business model document that they shared with the class through a Google doc. During and shortly after each presentation, the instructor asked students to provide feedback using Google's default commenting features, which students accessed using their laptops (see Figure 3).

To promote diversity of comments and to scaffold appropriate responses, students were encouraged to comment from one of four framing perspectives:

- Breakdowns: Think of problems that could cause this service to break down.
- Competitors: Think of existing and potential competitors to this service.
- Stakeholders: Think through the perspective of the people involved: users, providers, investors, marketers, and local businesses.

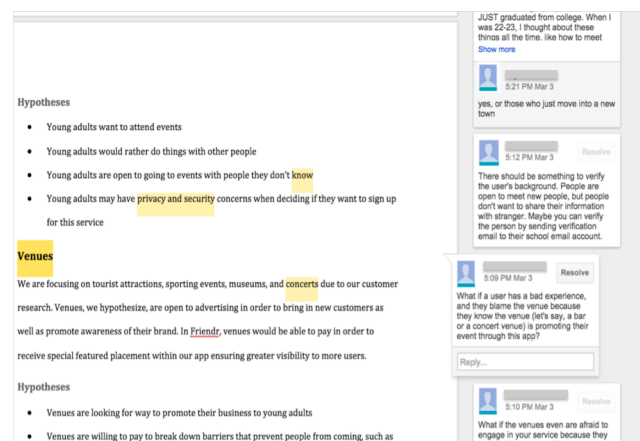


Figure 3. Business model for Friendr and the feedback they received as comments on a Google Doc.

- Scenarios: Think of additional scenarios where this idea could be applied.

These four framing perspectives were intended to stretch students to think about different factors that could affect the design of a mobile app. Students were assigned different perspectives for each presentation.

We collected and analyzed student and faculty comments on each presentation. After both sessions ended, students filled out an anonymous online survey about the experience; 84% participated. We collected data about class participation, students' technology use during class, and their attitudes about the perspectives they were assigned. Students were also asked to compare their participation in providing feedback during the presentations with how they provide feedback in other courses.

When surveyed about Facebook use during class, 40% of students reported using Facebook in class once a week and 27% reported using Facebook every class session. 24% reported once a month use, and only 9% said they never use Facebook in class.

Results

In presenting our results, we combine analysis of comment data with survey results to highlight five important criteria for student feedback that emerged from our literature review: relevant, copious, timely, diverse, and reflected-on.

Relevant: 80% of students who responded to the survey said that the comments they received were “helpful” or “very helpful.” We find student beliefs about the helpfulness of comments a useful proxy for relevance; they are the ones who must interpret the comments and decide how to use feedback to revise their work.

Copious: Overall, 36 out of 53 students (68%) commented at least once during the two class sessions. Across the nine presentation documents, students made 242 comments, for an average of 26.7 comments per document and 7 comments per student. Of the 36 students who commented at least once, 33 (90%) reported that they felt they gave more feedback using written comments than they would have given verbally in class.

Timely: 88% of feedback was given during class, and was available to the presenting group immediately after their presentation. Of the feedback given after class, most was from the instructor giving grades on the assignment. Twelve student comments arrived after class had ended.

Diverse: 77% of comments used one of the four framing perspectives. However, only 14% used the perspective assigned to the student at that time; 63% of student comments came from a different perspective than the one assigned, and the remaining 23% of comments were not from any of the perspectives. In other words, students commented from a variety of perspectives even when asked to focus only on one. 38% of students reported their assigned perspective was “difficult” to adopt, and only 40%

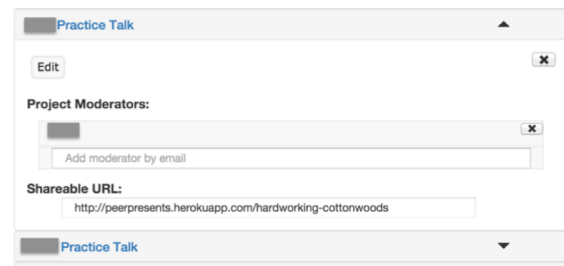


Figure 4. Presenting students can add team members, and distribute a short URL to feedback providers.

found the perspective “helpful” for inspiring new ideas while commenting. Given that 77% of comments came from one of the assigned perspectives – even when not assigned to that student – the data show that students found the scaffolding helpful, but felt restrained by having to comment from one perspective.

Reflected on: Out of 242 total comments, presenting students made only 5 comments in reply to the feedback their team had received. Based on the data we collected, we cannot draw conclusions about how students reflected on peer feedback.

Discussion

The exploratory study provides preliminary support that in-class feedback can be relevant, copious, timely, and diverse. This was achieved without implementing review requirements, mandating additional time outside of class, or requiring specific hardware. However, we see less evidence regarding how students engaged with the feedback received. Google Docs collapses longer comment threads, making it difficult for students to read all feedback on a document, or even know how much feedback is available. Google Docs also did not explicitly support reflection processes, and so future systems should address this need.

While in-class feedback did result in a diverse set of student comments, students did not seem to use the prescribed perspectives. Students were instructed to comment from a single perspective, but instead commented from many perspectives – creating even more diversity of feedback than we tried to scaffold. Students reported they did not use the framing perspectives as prescribed, partly because it felt limiting. We hypothesize that students are both willing and able to adopt multiple perspectives while commenting on a presentation. However, scaffolding may still be necessary to ensure that providing diverse feedback perspectives remains relevant to presenters' needs and the instructor's goals; we therefore reframe this as an issue of ensuring that peer feedback—which is naturally diverse in large classrooms—remains relevant. Future systems should focus on how to scaffold relevance, rather than diversity.

While we were initially concerned about placing a cognitive burden on students in the evaluation study, our preliminary observations tell us that students have a cognitive surplus during class, especially during peer presentations, which

they often spend on non-academic activities like checking Facebook. A well-designed in-class peer feedback system could give students a pedagogically meaningful activity to potentially replace Facebook and other distractions with academic exercises.

Finally, the prototype did not support all students equally effectively. Most students felt comfortable giving and receiving comments on their work, but a minority of students (7 out of 45 survey respondents, or approximately 15%) felt that commenting during the presentation was distracting for the presenter. Additionally, some students reported feeling overly criticized and judged, or that commenting felt like a "hazing" process. This feeling of being judged may make peer feedback less effective and reduce learners' willingness to participate. Future systems could do more to address student risks and ensure peer feedback remains focused on the work, not on the personal characteristics of the student.

To address the findings from our exploratory study, we expanded our notion of in-class feedback to encompass the process before, during, and after class.

DESIGN OF A NOVEL IN-CLASS FEEDBACK TOOL

In our exploratory study, we validated the concept of exchanging peer feedback during class using web technology, and we gained insights on how to design a system that supports relevant, copious, timely, diverse, and reflected-on feedback. In creating PeerPresents, we focused on features that would build on the successes of the exploratory study while reducing the burden on the instructor, providing scaffolding to encourage relevant comments, mitigating risks for students, and encouraging reflection on feedback.

Before Class

Question scaffolding: To create effective scaffolds without placing an additional burden on the instructor, PeerPresents allows each team of presenting students to author rubric questions in preparation for their presentation (see Figure

6). These questions are presented to the class during the presentation, allowing presenting students to receive feedback better tailored to their goals. Not only do the questions provide a guide for students giving feedback, but the process of generating questions also encourages teams to reflect on what type of feedback would be most useful, and how to ask effective feedback questions. Presenting students can also decide when each question goes "live" for peers to answer.

Additionally, structuring feedback around questions rather than around, for example, slide numbers allows our system to accommodate presentations of many types – formal slide-based presentations, in-class role-play, video pitches, and more. Presenters can design questions that respond to the specific format of their presentation.

Permissions and Dissemination: In PeerPresents, students can add project group members to their presentation, so that the instructor does not have to input teams for the entire class. The system also automatically creates a short URL so presenters can easily direct classmates to their presentation (see Figure 4).

During Class

Pseudonyms: To help reduce the perceived risk around peer feedback, while still providing a degree of accountability, PeerPresents allows feedback providers to choose a pseudonym when accessing the system. This pseudonym appears on every comment they make, which is visible both to other students in class for voting and to the presenters for reflection. Because students can choose obscure or identifiable pseudonyms, students can decide in each class session how anonymous they would like to be.

Voluntary Feedback and Voting: During the presentation, peers can answer each question provided by the presenters as many or as few times as they choose (see Figure 6). They can also choose to provide comments in a "default" open-ended text box. PeerPresents did not support discussion



Figure 5. Presenting students see all the feedback they received, with the ability to tag, sort, and organize comments. (All names and pseudonyms removed for anonymous submission)

Figure 6. Peer feedback interface: Peers respond to specific questions as many times as they desire.

threads between students to minimize distractions during the presentation.

Peers can up-vote or down-vote comments from other students; this helps the presenters identify comments that are important, popular, or controversial. Comments are displayed in real time throughout the presentation on a separate voting page (see Figure 7).

After Class:

Reflection: Presenting students can immediately view all their feedback with the timestamp, author, up/down votes, and framing question (see Figure 5). Students can then tag and filter comments to organize their feedback in a meaningful way. The system provides default tags for students to mark Positive, Negative, and Important feedback. Any presenting team member can individually create additional tags, which are visible to all team members. The system also displays how many comments have been recorded under each author, question, or tag. Students can filter comments by author, question or tag, and sort comments by least or most recent, author, and number of votes. To increase familiarity, we designed the filtering and sorting process to resemble many consumer product websites.

Not only are these features novel within the design space of peer feedback systems (see Figure 2, above), they also work together to address the issues raised by our exploratory study and to improve the peer feedback process.

PRELIMINARY SYSTEM EVALUATION

To evaluate our system, we asked six PhD students to use PeerPresents while practicing for a PhD requirement talk—a twenty-minute research presentation followed by a ten-minute question period. This presentation is a requirement for the doctoral program in the authors' academic department. Faculty members judge each presentation on research content, communication style, and slide design.

Methods

Six students received comments on their presentations, and fifteen people (13 students and 2 faculty) provided feedback. We collected survey data asking participants to comment on their experience with the system with respect to the relevance, quality, timeliness, diversity, and reflec-

Vote on the following comments from fellow students.

Figure 7. Students agree or disagree with the responses of other students providing feedback.

tiveness of feedback, and we analyzed the feedback provided by peers and faculty. The research team developed metrics to categorize comments into the following five types of feedback: *On Topic*: 1) research content, 2) communication style, 3) slide design, and *Off Topic*: 4) emotional support, and 5) other. We also tracked whether feedback made reference to a particular slide by number.

The practice session happened five days before the final presentations, so the talks were still in progress at this stage. This also meant that comments on communication style and slide design would be highly relevant, even if they might not be as important for practice talks in other contexts.

Given the constraints of the presentation context, we made some modifications to PeerPresents. First, the PhD program has a specific form for providing written feedback on these talks. Rather than have presenters develop their own questions to scaffold feedback, we used the same questions faculty would use to evaluate the real talk. For example, students would be evaluated on how the research was “situated in a larger theoretical context”, if the research was “communicated in an understandable way”, and whether “the slides followed good aesthetic design principles.” All students would be evaluated by the same rubric.

After the practice session, we asked presenters to reflect on the feedback in a spreadsheet and to use the filtering features to mimic tagging and sorting their feedback. (This informed key features for the PeerPresents reflection page, which was under development at the time.)

Results

Relevant: Five out of six presenters responded that the feedback was relevant. In coding the comments across all presentations, we found that 89% of comments were on topic (45% content, 15% communication, 29% design) and only 21% were off topic. (Total percentages sum to over 100% because some comments included multiple types of feedback.) Despite concerns that off-topic feedback might be negative or judgmental, we found that the vast majority of off-topic feedback—90% of all off-topic comments—provided positive emotional support. Only 2% of comments

were completely unrelated to the presentation or presenter (e.g. “hi” or “Lightning bolt! Lightning bolt!”), and none were negative.

We also found that 33% of the comments mentioned a specific slide number. Mentioning specific slides seemed particularly salient to presenters. Students commented that they “appreciated the feedback on specific slides” and “got specific details that I would not have gotten from discussion.”

Finally, we found that instead of answering all questions on the feedback form, students put 44% of their feedback into first question visible at the top of the form, asking about the content of the talk in general. The second most frequently answered question (asking for feedback on communication skills) was the form's second question; it received 13% of all feedback.

Copious: Across all six presentations, there were 338 comments. Remarkably, feedback providers gave an average of 24 comments, something that would not have been possible during a 10-minute verbal feedback session. In the open-ended survey, participants responded that they “got a lot more feedback in this form, than traditional ways” and that it made it “easy to give lots of feedback.”

Timely: All commenting happened either during the 20 minute talk or within the 10 minute Q&A period immediately following each talk. The total session for all six talks lasted three hours. According to our debrief discussions with presenters, all participants were eager to see their feedback immediately after their talk. When students knew that feedback could be available immediately after their presentation, they preferred not to delay even half an hour while another student spoke.

To minimize distraction, we asked students providing feedback to answer questions throughout the twenty-minute research presentation but wait to vote on others’ comments until the ten-minute Q&A period. Participants expressed a desire to see others’ responses to questions sooner, rather than waiting until after the presentation had ended.

Diverse: Participants were pleased with the diversity of their feedback. In addition to receiving comments regarding presentation skills, slide design, and research content, presenters also commented that they received a mix of detail-oriented and general feedback, and a balance of comments stating a problem and comments offering a solution. Presenters also recognized that the diversity in their feedback was in part due to the number of diverse perspectives represented in the audience.

Reflected On: We asked presenters to use the filtering features in a spreadsheet to mimic the feedback tagging and sorting features in PeerPresents. While not all presenters used the tagging feature, all mentioned frequently referring to their feedback during revision. One presenter told researchers her feedback contained a lot of “why” questions

asking her to explain the validity or reasoning behind specific statements she made in the presentation, saying, “[the feedback] tells me I haven’t found the right words or the right slides to tell the story yet.”

Feedback providers voted on 120 of the 338 comments; 177 total up-votes and 7 total down-votes were given. The average feedback provider voted on 12 comments. Of the 113 comments receiving up-votes, 73 (65%) received only 1 vote and 30 (27%) received only 2 votes. No comment received more than one down-vote.

Most participants entered their real name as their pseudonym in the system. Twelve out of fifteen participants used their real name, or a variant on it, including five out of six presenters.

Discussion

Our preliminary evaluation of PeerPresents demonstrates that a custom in-class peer feedback system can yield relevant, copious, timely, and diverse feedback, as well as provide time and tools for reflection. In addition, we were able to address student concerns about negative personal judgments and minimize the burden on the instructor in setting up our system. We also identified a number of issues for future research and development.

Peer feedback as legitimate peripheral participation

As described above, we observed copious feedback being provided to presenters by their peers. However, we also observed that our system supports a variety of different levels of engagement and participation. Three feedback providers gave significantly more feedback than the average, with 80, 71, and 66 comments respectively. Others made only a few comments; four feedback providers made fewer than five comments apiece. The type of comments also varied: all fifteen gave feedback on slide design, nine spoke about communication skills, twelve about research content, and thirteen gave emotional support.

Building on theories of legitimate peripheral participation, we take this diversity of participation styles as a measure of the success of our system. Legitimate peripheral participation describes how novices become experts by participating in simple tasks that are well within their capabilities, but as part of a larger community in which they can receive feedback from more experienced members [18]. Similarly, PeerPresents does not require individual feedback providers to give a certain amount of feedback, but rather lets individuals choose the amount and type of feedback they are comfortable providing. This theoretical approach, however, suggests that it is important to make expert behavior visible to novices for modeling and learning purposes. For example, we can investigate the impact of design decisions such as highlighting faculty feedback with a different color.

Challenges of feedback questions

The PeerPresents system uses questions to inform peers about the feedback most relevant to presenters, and to remind them about presenter needs as they give feedback.

The system succeeded at focusing the feedback providers, as the vast majority of feedback was relevant. However, more than half of it was given in response to the first two questions on the feedback form (see Figure 6). These two questions received a variety of on- and off-topic feedback. The first question was a place for general open-ended feedback, and about 55% touched on the basic research content (as opposed to presentation style or slide design). The second question asked for input on communication skills, and here only about 59% of feedback touched on the presenter's communication skills and slide design. This suggests that feedback providers were able to use questions to scaffold relevant feedback, but that they sometimes provided feedback that did not match the question being asked (e.g. 36% of responses to the second question were about research content rather than communication skills). Providers also chose not to respond to questions later on the list.

We infer that feedback providers behaved this way because the feedback form contained nineteen questions. With so many questions, finding a particular question meant scrolling through multiple pages – time that feedback providers preferred to spend commenting. This is in line with prior work that suggests students often do not read rubrics in their entirety [1]. Additionally, the questions were intended to evaluate a finished presentation, not a work in progress. Students remarked that while there were too many questions, they also did not cover everything they wanted to comment on. Searching for a question that might not exist may have seemed like a fool's game when an open-ended comment box was convenient.

We found that the system worked, but that the question scaffolding may need further consideration. There may be a practical upper limit on how many questions commenters can effectively respond to. We did not test what makes an effective question for feedback, but we can learn from existing research on rubric formation (e.g. [2]) to provide guidance for helping students construct questions to guide feedback in future iterations of the tool.

Limitations on voting

On average, feedback providers made twice as many comments as votes, even though commenting required more time and effort. We noticed that general comments (like “you may want to talk slower”), or comments that were easy to agree with (like “you are a great speaker”), received the majority of the up-votes. We hypothesize that this happened because many of the feedback comments lacked context after the fact. For example, some feedback providers said they could not agree or disagree with someone else's comment because they did not remember the slide being referenced. Even when a comment did not mention a specific slide number, there was not always enough context after the fact for feedback providers to agree or disagree. While presenters were generally able to make sense of comments by referencing their own slide deck or recalling their presentation, the other feedback providers lacked the context they needed to be helpful

up/down voters. While this difficulty may have been exacerbated by using the departmental feedback form instead of presenter-authored questions, we note the reconstruction of context as a future challenge for our work.

Very few of the votes were down-votes – only seven out of 184 votes. The lack of context may have made feedback providers even more hesitant to criticize than to applaud other people's comments, since they might be lacking context that would make the comment productive. Other research suggests that providing only upvoting, instead of upvoting and downvoting, can help minimize evaluation anxiety for students in a peer feedback context [15]. Removing the option to disagree with students in PeerPresents might benefit the classroom culture and help students feel more comfortable with the peer feedback process.

We also note that 35% of comments that pointed out problems also included a suggestion for how to address it; this could help mitigate the criticism. Taken together, this data makes us ask whether students are being sufficiently critical of one another's work, or whether additional scaffolding is needed to help feedback providers express appropriate criticism of the comments provided.

Pseudonymity and learning culture

While we provided the option for participants to use pseudonyms as identifiers in our system, the majority of participants chose to use their real names, or variants on their real names. While being identifiable may produce social risks for students in some contexts [6], in this study, being identifiable was seen as a positive. Because they personally knew each feedback provider, presenters found their knowledge of that person's background and expertise helped provide context for specific comments. Having the option to be identifiable also served as a partial way of allowing experts to model behavior. Because the faculty members attending the talk chose to be identifiable, students were able to give their comments higher priority.

This does not imply that identifiability is necessarily better than pseudonymity. What we observe is a particular learning culture, one in which all participants know each other well and had established trust before the study. This type of learning environment is conducive to productive peer feedback [19], and we hope to investigate how PeerPresents can foster such a classroom culture in a variety of learning environments, while still supporting learning environments that do not yet have these characteristics.

Class size

While we believe PeerPresents may be particularly helpful to instructors of large classes, our small-scale preliminary evaluation indicates that high-quality peer feedback can be useful for classes of all sizes. The 15 students in our preliminary tool evaluation were able to instantly give a detailed critique of their peers' work, allowing presenters to rapidly iterate and improve their presentations.

Distraction

One concern with using this tool in real-time is that the system could become a distraction during student presentations. For example, students might be reading and voting on peer's comments and stop listening to the presenter. Also, how will the presenter feel if everyone in the audience is looking at their laptops instead of at the slides or speaker?

In our preliminary study of the system, participants did not express distraction as a concern, neither when they were giving feedback nor when they were presenting. Perhaps this is because students in our study are accustomed to being on laptops during presentations. However, we recognize this would not be true for all classroom contexts. A fruitful avenue for future work will be to investigate how facilitate minimally disruptive in-class feedback.

Role of the instructor

PeerPresents does not specify what role the instructor plays while students are using the system. We envision that the instructor could use PeerPresents to help students develop good feedback skills, such as guiding students as they write feedback questions, providing comments through the system during presentations, and evaluating the quality of the feedback students provide. Further design work can explore the best ways to support how instructors might interact with PeerPresents.

Limitations

Our study recruited a limited sample to test PeerPresents, consisting of graduate students and faculty from a single department. We have implicitly compared our tool to a verbal Q&A session, rather than testing it in comparison to a similar system, or to other existing approaches such as email or paper-based feedback forms. Further, PeerPresents' reflection page was still under development during our initial evaluation; for example, participants may have organized their feedback differently in Excel than they would when using the PeerPresents reflection page. In addition, the exploratory study and preliminary system evaluation did not fully investigate the instructors' perspective towards implementing this type of system in their class. We expect to gain insights about what instructors need from this system when we deploy PeerPresents in classrooms.

FUTURE WORK

The issues discussed above suggest avenues for future research, as well as provide insights to help us iterate our tool. A more rigorous future evaluation of PeerPresents would compare this tool to analog methods as well as to other digital feedback systems. We also believe this system could be generalized to other contexts, such as conferences. In the longer term, we will be investigating the following three research areas related to in-class technology.

Scaffolding Question Formation and Reflection

Discerning what questions to ask when asking for feedback is a skill that many students may not have fully developed. We intend to explore ways PeerPresents can help students ask

more helpful questions, and investigate how students reflect on the feedback they requested.

Studying Instructor Adoption

In-class tools only work when the instructor is willing and able to adopt them. While extensive literature on instructor adoption of education technology exists, there is no literature on adopting in-class peer feedback systems. We are well suited to contribute to this body of literature with future studies.

Investigating Classroom Culture

While most students responded positively to our tool, we recall the student from our exploratory study who compared the critique process to "hazing." On the other hand, many students in our exploratory and preliminary evaluation study used the tool to offer emotional support to their peers. We will investigate how PeerPresents can reduce the risk students feel when presenting and critiquing work in a classroom, both with and without an established culture of peer feedback.

CONCLUSION

In this paper, we have presented a successful prototype of an in-class peer feedback system for student presentations. PeerPresents is a browser-based system that enables presenting students to write feedback questions before class, which get prompted to peer feedback providers during class. On any device, peers can quickly provide feedback and vote on others' feedback. The system also provides tools for the presenting students to organize and reflect on feedback after class. Our preliminary evaluations demonstrate that in-class peer feedback systems can elicit relevant, copious, timely, and diverse feedback. By allowing students to generate scaffolding questions before class and enabling feedback provision during class time, we maximize the time for student reflection on feedback after class. We have also highlighted a new design space for classroom tools, and extracted generalizable design lessons for future work.

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