Crowd-Sourced Peer Feedback (CPF) for Learning Community Engagement: Results and Reflections from a Pilot Study

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Abstract
The goal of this study is to develop a new approach to collaborative peer feedback enabled by social media, understand how it is perceived by university students, and develop insights regarding its impacts on learning. We adapted a crowdsourcing platform that enabled students to submit their own assignments, and enabled students and outside experts to assess the quality of assignments using voting and commenting. We call this approach "crowd-sourced peer feedback" (CPF). Results of our pilot study suggest that viewing and commenting on other assignments increases engagement, mobilizes motivation, and may enhance learning. In contrast, mixed results were found for voting and the use of badges and points. Finally, minor design choices in how the CPF platform is implemented may have significant impacts on learning experiences. We provide suggestions for future research and for the use of CPF to enhance learning.

1. Introduction

According to the wisdom of crowds, aggregating information and decisions of diverse individuals can result in better decisions relative to those made by a single person [21]. Crowdsourcing has gained prominence in business arenas such as generating user-driven innovations [5, 12]. However, it has not been widely applied in learning and education. For example, it is difficult to grade thousands (or tens of thousands) of assignments (essays, projects, etc.) in massive open online courses (MOOCs). A current popular approach to online peer feedback requires each student to grade three to five other assignments (and typically only see those assignments) using an instructor-provided assessment rubric. In contrast, we define crowd-sourced peer feedback (CPF) as interactive feedback on submitted assignments from a large and diverse set of individuals, including such features as voting, commenting, points, and badges.

If crowdsourcing does indeed yield better decisions, crowd-sourced peer feedback (CPF) may yield a more accurate grade versus the average of just a few grades.

The application of crowdsourcing in the learning context may yield other benefits beyond the assessment of assignments. For example, corporate crowdsourcing initiatives such as My Starbucks Idea can enhance stakeholder engagement and strengthen customer loyalty [7]. Might CPF enhance student engagement with course material, motivate higher learning goals, broaden skill sets to include effective feedback, support reflective learning practices, and enhance overall learning outcomes?

Despite these intriguing possibilities, we could not find any prior studies of CPF in an educational context. We thus ask the following research question: How does crowd-sourced peer feedback (CPF) shape learning experiences and activities and what is the impact on learning outcomes? (Figure 1).

The rest of the paper is organized as follows. In the next section we review prior research on general forms of online peer feedback such as discussion boards and overview theoretical perspectives on learning. Next we describe the design of the pilot study. We then discuss key findings from our qualitative study of student experiences. We conclude with instructor reflections and suggestions for future research and for practical implementation of CPF.

2. Prior research and theory review

2.1. Prior research

Prior research of online education is voluminous, spanning analysis of online learning effectiveness [23] as well as factors that drive online learning.
adoption, perceived satisfaction, and success [18-20]. We identified several studies of online peer feedback (Table 1).

Blog comments from peers assessing writing assignments were found to help in improving outlines and first drafts [28]. Use of a specially designed blog platform enabling comments and numerical rating found a correlation between platform usage and course grades [22]. Similarly, peer comments on posts in a writing class fostered discussions among learners and peers [11], while the type of feedback may impact the extent to which it is applied [24]. In an experimental study, the efficacy of online peer feedback was found to depend on thinking styles and feedback format [13].

Conceptions of learning have also been found to moderate learning outcomes in the online peer assessment context [27]. Related to this, findings suggest that student perceptions of online peer feedback tend to be as an assessment tool rather than as a learning tool [25]. Finally, both learning and satisfaction were higher in a student group supported by peer feedback versus a control group [26].

Beyond the lack of prior research examining CPF in higher education, we also observed that most studies use quantitative empirical approaches. Though this methodology has many benefits, a key limitation is that questions of how and why remain unclear. As emphasized in prior research: “For future research, the way feedback is processed should be studied more qualitatively in order to understand the reasons for revisions.” [24, p. 1815]. To address this challenge, we adopt qualitative approaches.

Ethnographic approaches capture rich contextual experiences (actions, emotions, sound, etc.) using various methods such as participant observation, field notes, and interviews [15]. Ethnography can provide insights into how (and why) the design of an online learning platform interacts with learning experiences to yield learning outcomes. For example, a recent experiment found that students in a “flipped classroom” augmented by online video performed much better than students in a traditional class, but the lack of ethnographic data made it difficult to know what it was precisely about the online format (flipped structure, online videos, etc.) that produced such drastic learning outcome enhancements [9].

We did identify a study using interviews [27] as well as one employing “virtual ethnographic research” focusing on reflective student postings on class discussion boards [10]. This method yielded insights that would have been difficult to generate using traditional methods. For example, the study identified the importance of motivation, which for some students depended on online group membership enabling meaningful social interactions, while for other students, was a key limitation of online learning in general, which does not allow for “face-to-face” interaction. These results, while subject to confirmation in large-sample studies, provide a glimpse into the kinds of rich insights that can be captured by ethnography that may be missed using quantitative empirical methods. For these reasons, we employed ethnographic rather than quantitative empirical methods.

### Table 1. Illustrative prior research

<table>
<thead>
<tr>
<th>Topics</th>
<th>CPF platform</th>
<th>Vote</th>
<th>Comment</th>
<th>Badge</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback value [6]</td>
<td>✕</td>
<td>✕</td>
<td>✔</td>
<td>✕</td>
<td>✕</td>
</tr>
<tr>
<td>Motivation [10]</td>
<td>✕</td>
<td>✕</td>
<td>✔</td>
<td>✕</td>
<td>✕</td>
</tr>
<tr>
<td>Feedback type [11, 24]</td>
<td>✕</td>
<td>✕</td>
<td>✔</td>
<td>✕</td>
<td>✕</td>
</tr>
<tr>
<td>Thinking styles [13]</td>
<td>✕</td>
<td>✕</td>
<td>✔</td>
<td>✕</td>
<td>✕</td>
</tr>
<tr>
<td>Learning quality [26]</td>
<td>✕</td>
<td>✕</td>
<td>✔</td>
<td>✕</td>
<td>✕</td>
</tr>
<tr>
<td>Perceptions [25, 27]</td>
<td>✕</td>
<td>✕</td>
<td>✔</td>
<td>✕</td>
<td>✕</td>
</tr>
<tr>
<td>Blog posts [22, 28]</td>
<td>✕</td>
<td>✔</td>
<td>✔</td>
<td>✕</td>
<td>✕</td>
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<tr>
<td>CPF [Current study]</td>
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In summary, there is a growing research stream examining the role of online peer feedback in fostering positive learning experiences and enhancing learning outcomes. This important research has yielded many insights. However, we could not find any studies using a dedicated crowd-sourced online platform enabling voting, threaded commenting, and the use of badges to indicate milestones in an educational context. To emphasize the most salient differences between CPF and conventional feedback, the former involves interactive feedback from a large group of diverse individuals while the latter assigns a single or a few peers to provide feedback for a particular assignment.

2.2. Theoretical perspectives on learning

Perspectives on learning can be grouped into four principal categories according to how learning is conceptualized (Table 2) [2]. For example, the behaviorist perspective suggests that external stimuli drive changes in behavior, which indicate learning. In contrast, the cognitivist perspective views learning as something done in the mind that may or may not correspond to a change in behavior.

Each perspective offers a different implication for how and why CPF might enhance learning. Taken
together, these can be summarized as: 1) learning how to give appropriate feedback by viewing the feedback behavior of others, 2) incurring a mind shift of learning by struggling with an assignment and then viewing the completed assignments of others, 3) learning by making meaning of the new CPF online context, enabled by motivating features, and 4) learning enabled by the enhanced network structure of the CPF platform to better connect the learning community.

Synthesis of various learning theory perspectives into a set of principles also suggests the potential benefits of CPF [1]. For example, one principle emphasizes the role of goal-directed learning coupled with targeted feedback in driving learning quality. CPF provides abundant and targeted feedback relative to specified performance criteria, suggestions for improvement, and is nearly immediately available upon posting the assignment. Another learning principle is the importance of motivation in determining the quality of learning behaviors. CPF provides several motivations, including massive peer transparency, an innovative online environment, and badges and a leaderboard to motivate various performance objectives.

<table>
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<tr>
<th>Table 2. Perspectives on learning</th>
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<tr>
<td><strong>Learning Occurs When…</strong></td>
</tr>
<tr>
<td>Behaviorist</td>
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<tr>
<td>Cognitivist</td>
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<tr>
<td>Constructivist</td>
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<tr>
<td>Connectivist</td>
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In summary, our brief overview of learning theory perspectives and synthesized evidence-based learning principles suggests multiple avenues by which CPF may enhance student learning. However, given the lack of empirical CPF studies, we have no direct evidence to support or refute these possibilities. We now describe our pilot study as a first step toward gathering such evidence and gaining insights into CPF.

### 3. Pilot Study

#### 3.1. Design

Despite the lack of prior research on the use of crowdsourcing as a means of peer feedback in education, we used a human-centered design process [15] (also known as design thinking) to develop the online learning pilot and design goals (problem-centered approach of design science research methodology [17]). Although we collected quantitative data from the CPF platform, our primary source of data is ethnographic inquiry and observation, making this a qualitative study.

Our process was as follows. First, we explored the design space by watching videos used in different types of online learning (K-12, college, etc.), examining MOOC classes, talking to colleagues about their experiences using online learning, asking students to walk us through a current online learning platform, reading about experiences from the literature, examining existing instructional design models, and so forth.

Second, we synthesized these data (notes, photos, videos, documents, etc.) using tools such as personas (to create “real” people to design for), customer journey maps (to understand the learning journey in a synchronous online class, asynchronous class, etc.), mind maps (to capture e-learning best practices), and other tools. For example, several authors have built on the well-known Bloom Taxonomy of learning [4] and applied it to online learning, which provided the basis for one of our mind maps.

Our design research revealed several gaps and opportunities in the design space, with the overarching theme that “learner-centered” approaches (focusing on individuals including background, experience, etc. as well as promoting motivation, engagement, and achievement) are likely to yield positive learning experiences and promote enhanced learning outcomes [3, 14]. To make our pilot study manageable, we focused on a few salient insights that we discovered in our design research and formulated design goals (Table 3).

#### 3.2. Structure

The pilot study was conducted within an MBA elective entitled “Service Innovation Management” containing 40 students. The learning objectives of the course included: describe a human-centered design framework (also known as design thinking) called EDCI; describe and apply specific approaches within each phase of the EDCI framework such as
contextual inquiry; apply the EDCI framework within a group project focusing on development of valuable new digital services (many targeted at environmental sustainability); describe how EDCI fits within other approaches to innovation; demonstrate the value of empathic approaches to innovation; and use reflection and sense making to expand thinking about what is possible in the context of wicked problems such as climate change and online education.

Table 3. Design goals

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
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</thead>
<tbody>
<tr>
<td>1. Commenting</td>
<td>An improved online learning experience would leverage crowdsourcing to enable students to engage in commenting threads about their assignments.</td>
</tr>
<tr>
<td>2. Voting</td>
<td>An improved online learning experience would leverage crowdsourcing to enable students to vote on whether peer assignments met the requirements or not.</td>
</tr>
<tr>
<td>3. Gamification</td>
<td>An improved online learning experience would leverage crowdsourcing to enable students to earn points and badges for actions such as tagging, commenting, etc.</td>
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</table>

Structurally, the course is divided into five modules: getting started, exploring the design space, discovering insights, conceiving and designing solutions, and synthesis and reflection. Each module contains specific learning points and action-learning assignments. Figure 2 contains an illustration of a completed assignment component. Assignments are the focus of CPF and are typically due on Monday, students begin posting days before, and all assignments are immediately transparent to all students. Finally, numerous outside experts were enlisted to provide comments on student assignments to increase the size and diversity of the “crowd.”

The two main processes on IdeaScale are submitting an assignment and voting or commenting on an assignment. Although the submission process is fairly uniform, the feedback process varies. For example, a student may not click on any sorting button and simply see a list according to the default sorting (Recent), click on an assignment toward the top, and vote or comment. On the other hand, a student may click on “Popular,” view a few assignments, get inspiration for her own assignment,
make a few notes, click on other assignments, and finally vote and comment on a few.

In the case of voting, a student has two choices: Up or Down. In the main view (Figure 3), net votes (Up minus Down) are displayed in large font, while Up votes are displayed in green to the lower left of net votes, and Down votes are displayed in red to the lower right.

4. Data sources, collection, and analysis

Data were collected from two primary sources. The first source was IdeaScale, which provides quantitative data (analytics by function, time, and student) and qualitative data (e.g., comment threads). The latter builds on digital ethnography methods in prior studies [10]. The second data source was observations and interviews with students (ten students total), written evaluations after the course was completed, and instructor journal entries. We could not find examples of this type of data collection in prior ethnographic analyses of online learning (interacting with learners in physical and virtual space).

Analysis involved reading, color coding, and collating qualitative data by issue (axial coding); visualizing quantitative data using graphs and tables; and reporting observations, patterns, or anomalies. We emphasize that in the following although our findings are based on extensive data collection and analysis, they are nonetheless limited by our lack of quantitative empirical testing between groups given our single-class pilot implementation. Thus, our findings are most appropriately interpreted as rigorously developed propositions for future confirmatory quantitative studies.

5. Findings

Before examining specific design goals, we describe summary statistics of student participation in crowd-sourced peer feedback. The total number of votes cast (sum of Up and Down votes) was 593. The total number of comments was 545, with a tendency for highly commented upon assignments to receive more votes. This was not surprising: an outstanding assignment submission tended to garner many comments as well as many Up votes. At the same time, for each commenting level we observed wide variation in total votes. Indeed, many assignments that received no comments still received votes (Figure 4). Tagging assignments was also widespread, with over 500 unique tags generated and used by participants, e.g., “the big lebowski,” “don norman,” “human-centered design,” and “awesome”).

The distribution of voting and commenting exhibits a long-tail, for example, for commenting there are 70 assignments with 0 comments, 56 with 1, 33 (2), 17 (3), 19 (4), 7 (5), 7 (6), 5 (7), 3 (9), 1 (10), 4 (11), 4 (12), 1 (13), and 3 (14). A similar trend is observed for voting and commenting participation, with a few individuals contributing very high numbers of both (> 50) but most individuals contributing fewer (< 20). Interestingly though not statistically significant, students with the highest number of voting and commenting contributions also tended to receive the highest grades in the class, similar to prior research [22]).

Figure 4. Histogram of votes and comments

Similar to many online markets, the “market” for comments and voting in CPF exhibits a long tail, with potential implications for learning and engagement. For example, in the online realm many firms sell “less of more” by gaining large revenue from large numbers of niche products. In the CPF context, more research would be needed to determine how to design the platform and introduce incentives to maximize learning based on the apparent long-tail of peer feedback.

5.1. Design goal 1: commenting threads

Almost every student had a positive or strongly positive opinion about commenting. Regarding quality, one student stated that peer comments “seemed genuine, sincerely thought out, and not flippant.” This was a pattern echoed by many students: “been really impressed in general with the comments received,” and “really enjoy it considering I’m not up on social media.” Other students felt that team assignment comments were especially helpful: “team comments were good. We could use the feedback and improve something for the next round. We then did a better job presenting our ideas,” and “My group tends to read all the comments and learn for next time.” Regarding the tone of comments, one student reflected that: “all the comments seem to be more positive; would have liked to be more negative,
but felt like I would be out of place; the tone of it was so polite.”

One student described a reflective learning journey as follows: “when I see other assignments, I’m like wow! (can be kind of intimidating). For example, in the Martian observation I stopped telling a Martian story at a certain point (worried about length) … then got a lot of feedback around why I stopped there.” Another student described her journey as: “50/50 I would comment back on the comments made on [my] assignment.”

The value of rapid peer feedback in promoting a virtuous learning cycle was also underscored: “I think I learned the most from my classmates though, especially through IdeaScale. I learned so much just by viewing my peer’s work and how they thought through the same problems I did. … because I knew other people would see my work it forced me to think even more creatively.” Selective commenting back was mentioned by another student: “when I received feedback, responded to at least two of the comments; if they said they didn’t get it, I would help explain.” Finally, one student voiced a contrasting view: “we are not communicating with each other, a very one-way conversation, we’re commenting because we are supposed to.” Related to this, it is unclear what impact low numbers of comments and votes may have had on students who submitted these assignments (unfortunately, our data does not provide any insight in this regard, one way or the other).

In summary, we found strong evidence to support the proposition that assignment commenting threads supported reflective learning journeys via peer conversations and motivated some students to set higher goals. At the same time, there were a few exceptions, suggesting that learning experiences may be moderated by learner-specific characteristics, such as goals, expectations, or prior experience with online learning. Overall, behaviorism, social learning theory, and connectivism would appear to offer explanatory lenses consistent with these findings [3] (Table 2).

5.2 Design goal 2: voting

Despite the anonymous nature of assignment postings, commenting, and leaderboard point totals on IdeaScale, the overwhelming majority of votes (94%) were Up votes rather than Down votes. This was somewhat surprising, given that voting guidelines specified that an Up vote on an assignment indicated that it met the minimum standards as specified in the assignment rubric, while a Down vote indicated that more work was needed. The grading policy also specified that votes affect assignment grades, but that the instructor makes the final call based on commenting threads, votes, and his own assessment.

Regarding student experiences, only a few students commented about voting in response to open ended questions about IdeaScale learning experiences. One student stated that “Voting was a bit of a joke. The assignments posted first would get voted on more often.” The notion that the order in which assignments were presented to students (by number of net votes) affected which assignments were voted on was echoed by another student: “like the voting aspect, otherwise it seems haphazard for where your idea shows up; then it got buried.” Not all students were swayed, however: “I rarely looked at net votes to figure out what to look at.”

Regarding the efficacy of crowdsourcing as a means of assignment grading, the instructor selected one team assignment to rank order in terms of quality, and then checked this order against that implied by net votes: the two independent orderings aligned almost perfectly.

In summary, we observed mixed and somewhat muted student responses to voting. This was somewhat surprising, but may be driven by contextual or specific characteristics of the current implementation, such as a failure to establish a voting culture that Down is acceptable and appropriate. Regarding assessment, voting may correlate with quality. Also, the order in which assignments are presented to students appears to be an important design parameter. This latter point has implications for the design of CPF interfaces. Finally, if the information embedded in votes is not deemed valuable, students do not learn from it, consistent with the cognitivist learning perspective (Table 2).

5.3 Design goal 3: points and badges

Students received points in IdeaScale for various types of activities, such as posting assignments, receiving votes, tagging assignments, spending time on the platform, voting on comments, and so forth. These points were added, a leaderboard was created, and points were used as one input into the online participation component of the course grade (Figure 5).

Overall, contextual inquiry, interviews, and other data collection methods indicated that badges were perceived by students as either negative or neutral: “Not into badges. It didn’t interest me as a person”, “Not a gaming person; couldn’t care about stamps, seals, badges.”

Another student provided a reflective commentary as to why badges were not effective in her opinion:
“Members of the … community have not developed an affinity or desire to achieve such badges. Awardees of badges didn’t strive to achieve the badges, rather they were given to them. Members of the community do not [apply] any significance to badge, and therefore do not compare their badges with each other.” Another explanation is poor communication by the instructor regarding the use of badges: “I didn’t realize i had any badges until we had an assignment,” and “Don’t really know the background mechanics of the badges; would rather spend time on people profiles.” Two useful suggestions included: “Can we vote on useful badges?” and “perhaps if the badges were attached to a grade level, there could be some value.”

From a learning perspective, crowd-sourced peer feedback appears to offer much in terms of opening up the “student crowd” for mutual engagement about submitted assignments (of any type). The learning experiences and activities enabled by CPF appear to increase engagement of students by prolonging their thinking about an assignment and encouraging them to think about the merits of other assignments. CPF also enables students to learn from other assignment strengths and limitations and possibly incorporate these insights to enhance their own assignments. Overall, CPF may also enhance learning outcomes, though further research is needed to isolate particular mechanisms and dimensions of learning. Returning to our definition of CPF (interactive feedback on submitted assignments from a large and diverse set of individuals, including such features as voting, commenting, points, and badges), the most compelling feature that we identified in our ethnographic study was many-to-many threaded commenting from a large and diverse set of individuals (students, former students, professionals in the field, etc.).

These findings are consistent with social learning theory (behaviorist and connectivist learning theory perspectives, Table 2), which posits that students learn from one another by observing (seeing what others post to IdeaScale, seeing what others say about those posts, observing voting patterns), imitating (getting a sense for what the crowd believes is an excellent assignment and attempting to achieve that level of performance, providing comments on other assignments that are similar in structure – pros, cons, improvements – to those of others), and via modeling (use of rubrics to guide students in assessing assignments) [3].

A potential challenge of CPF is groupthink, i.e., students collectively converging on a single approach to a particular assignment when several different approaches are equally valid if executed correctly. However, we found no evidence of this in our pilot. It is possible that despite our empathic approach to collecting data about student learning experiences, students remained reluctant to disclose such behavior. It is also possible that they engaged in groupthink without being consciously aware of it. Future research might collect quantitative data to build on these tentative findings, for example, to assess whether there is an association between students self-reporting a positive experience and the number of votes and comments they received on their assignments. It is also possible that other mechanisms were in force with respect to students who viewed assignments before doing their own (self-selection, positive reinforcement, procrastination, peer pressure,

6. Instructor reflections

Figure 5. Leaderboard

A few students did comment that they looked at the leaderboard and tried to achieve a higher ranking, but were stymied by the high point total of the “student” in the first spot (which was the anonymized instructor). This would appear to be consistent with social comparison theory [8].

In summary, badges and the leaderboard seemed to be generally ineffective at achieving enhanced learning motivation and learning experiences. This finding was somewhat surprising, given the emerging popularity of gamification of learning. However, it is possibly due to its specific implementation in this course or perhaps even the nature of the learners in the course (MBA students). From a theory perspective, given the way in which points and badges were implemented, we are hesitant to draw any potential conclusions.
etc.), which might be analyzed in future research using controlled experiments. For example, group polarization [16] in voting and commenting might be analyzed by including a treatment group (feedback is not anonymous) and a control group (feedback is anonymous).

From an instructor perspective, in the early stages of the crowd-sourced platform development there was much energy and optimism: “Personal emotional content around community emergence for me. Opposite to grading emailed assignments or even posts on a discussion board. The voting changes things, and the leaderboard” (instructor journal, end of first week of class). Grading is informed by peer comments, response comments, and net votes, becoming more enjoyable and ostensibly more valid: “I enjoy the ‘grading’ process more…it’s fun!” However, over time the number of individual assignments (400), team assignments (21), and comments grew to be overwhelming given no automatic connection between IdeaScale and the grading platform. This meant that every single one of the 421 assignments had to be approved by the instructor, a spreadsheet downloaded, and rows merged with a master spreadsheet. This grading time was exacerbated by the production of weekly screencasts and designing and delivering in-class sessions.

In sum, much more time was required versus that spent in previous versions of the class. One result was that not only did the students feel like the course was chaotic at times, so did the instructor: “Too much hassle to promote assignments in IdeaScale, then manually move over to grading in canvas. This needs automation. I can’t keep up!” (instructor journal, penultimate week of class). It is uncertain how much of this effort might be reused in future such courses. From a learning perspective, it is uncertain whether the impact of CPF on the motivation and energy of the instructor may have impacted instructor actions and subsequent learning outcomes.

7. Summary and implications

The main result from this study – though tentative and subject to further testing – is that crowd-sourced peer feedback (CPF) can significantly enhance student engagement and support positive learning experiences that are likely to enhance learning outcomes, as suggested by behaviorist and connectivist learning theory perspectives. A heavily action-based learning course can be effectively supported and enhanced by CPF, as we demonstrated in our pilot study. We see no reason why CPF applied to other types of classes such as calculus or history might not also exhibit these benefits.

The common underlying theme appears to be learner-centered approaches that support socialization (interaction and engagement) to stimulate both intrinsic and extrinsic motivation and motivate higher learning objectives in students. A range of fruitful research is suggested by this study, perhaps by using different research methods (e.g., quantitative empirical analysis), asking different questions (e.g., association between voting and expert assessment, association between learning and number of comments and votes), examining different contexts (undergraduates, different types of classes, etc.), and altering design choices (non-anonymous feedback, must post before viewing other assignments, different participation incentives, etc.)

For those considering the use of crowd-sourced peer feedback in higher education or researchers considering future CPF studies, we offer four considerations.

First, viewing and commenting on peer assignments are critical components of this new learning experience and their effective catalyzing and nurturing is likely to enhance learning outcomes. For example, the instructor might direct students to seek out uncommented upon assignments when voting or commenting. Another approach might be to enlist outside experts to vote and comment to enhance commenting and increase the chances that all assignments will receive votes and comments (as was done herein). Also, though crowd benefits may increase with a larger-sized crowd, optimal crowd size is unknown. At the same time, it is unclear whether student anonymity is a net positive, given the pros (mitigates potential gaming, subconscious group dynamics, etc.) and cons (eliminates social aspects, doesn’t feel as real, etc.). Finally, it is unclear whether the benefits of the current “view all anytime” even before submitting an assignment (inspiration, motivation, etc.) outweigh the costs (potential copying, bias, etc.). More research is needed to expand knowledge about these issues and inform better CPF designs.

Second, while voting is helpful for assessment, students do not perceive many benefits and did not express strong sentiment one way or the other. We found that the minor design choice of the default order in which assignments are presented may impact voting dynamics. One suggestion would be to change the default presentation to a random order mode so each assignment is equally likely to appear first (this may enhance both voting and commenting behavior). Another suggestion would be to remind students of
assignment rubrics and encourage a culture of honest voting (rather than simply finding a few assignments worthy of Up votes). Another suggestion is to provide students with the constraint that an equal number of Up and Down votes must be given (though this may unnecessarily complicate matters and may engender pernicious outcomes). Finally, an Amazon-style 1-5 scale rather than a simple up-down may yield better results [22].

Third, translating votes and comments into grades is non-trivial when adapting a system built for a different purpose (IdeaScale is built for idea contests, not for student assignment assessment and learning). This was a significant drain on the instructor’s time and a simple process proved elusive. Careful thought is needed to design a CPF platform that works not only for students but also for instructors.

Lastly, it seems likely that CPF could be a significant enhancement to a completely online class, given the ability to communicate assignments within the system (e.g., a group assignment screencast) as well as the social aspect enabling students to connect about each other’s learning and participate in gamification via effective use of badges and points.

These learning points and suggested practices are just a few of the many fruitful possibilities for the future application of CPF to enrich learning experiences and enhance learning outcomes.

8. Acknowledgements

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9. References

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