

Improving Feedback and Discussion in MOOC Peer Assessment Using Introduced Peers

Dilrukshi Gamage
*Department of Computer Science and
Engineering*
University of Moratuwa
Katubedda, Sri Lanka
dilrukshi.gamage@gmail.com

Mark E Whiting
Computer Science Department
Stanford University
Palo Alto, USA
mwhiting@cs.stanford.edu

Indika Perera[±], Shantha Fernando*
*Department of Computer Science and
Engineering*
University of Moratuwa
Katubedda, Sri Lanka
[±] indika.perera@cse.mrt.ac.lk
*shantha.fernando@cse.mrt.ac.lk

Abstract—Massive Open Online Courses (MOOCs) often use peer grading which enables the use of open ended questions in assignments at scale. Open ended questions enhance students' creativity and improve cognition. However, this peer grading includes drawback such as missing or low quality feedback, and inconsistency between peer graders. In design studios and highly connected MOOCs, a common practice is to use open feedback, visible to everyone in the community. Drawing inspirations from this technique, we hypothesize that introducing peers and allowing them to communicate with each other during peer assessment in a structured open learning environment will increase the quality of feedback. We tested this approach in a controlled study, comparing open to blind peer review, and found the technique led to higher quality feedback. We discuss implications using open identity grading in learning environments as a potential stimuli for students to interact more.

Keywords—MOOC, Massive Open Online Courses, Peer assessment, Peer grades, Peer evaluation

I. INTRODUCTION

Peer assessment in Massive Open Online Courses (MOOCs) [13] enables grading open ended responses with human feedback at scale, but is often not constructive or thoughtful [27], resulting in compromised learning. Due to the time it takes to grade assignments manually, many MOOCs use automated assessment techniques to grade work submissions at scale [38], or have adjusted their course design toward submissions that can be assessed rapidly. Activities which are simplified for ease of assessment, such as automatically gradable quizzes, reduce learning efficiency because these mechanisms allow minimal individualization of feedback. In these situations, automated grading is not capable of giving personalized feedback and the instructors can't give feedback to the massive number of submissions, so peer assessment is used by soliciting feedback from fellow students.

A challenge with peer assessment in MOOCs, is that often the feedback field is left blank, or the feedback is not helpful or not constructive [27]. For example common feedback submissions for a web design MOOC are "Great work!" or "Beautiful website!", which show that the students do not provide quality feedback in this process. Without the promise of quality feedback, students' rapidly lose interest in either providing quality feedback or learn effectively. In this way, feedback is considered one of the single most important factors

influencing student learning [1, 3] and MOOC learners often report that, even with peer grading, they did not get useful feedback to their work by peers [12]. However, in connectivism MOOCs or cMOOCs, a type of MOOC which has no specific structure central to a learning platform, practice connecting as a core tenant. It shares and provides feedback using various tools which often leads to personal quality feedback [31, 30].

We hypothesize that providing opportunities for peers to grade each other and allowing them to communicate will increase quality feedback and increase interactions in MOOCs with formal structure and centralized platforms (xMOOCs) such as Coursera, edX or FutureLearn. We relate to the hypothesis that the lack of quality peer feedback on MOOCs is due to a lack of accountability in feedback communication. Anonymous peer assessment or blind peer review is the standard practice in many online learning platforms, with the stated goal of reducing grading bias [10]. However, recent work on improving MOOC peer assessment revealed that a major issue arises due to increased anonymity, leading to a decreased feeling of community affiliation [37]. We emphasize that our intention of non-blind assessment focused only on open learning environments where students voluntarily enroll to learn and not in scholarly peer review settings in publishing or reviewing of any other type of contribution.

We present a MOOC peer assessment experience by producing an interaction design where peers can introduce themselves while providing a mechanism to communicate with each other in providing feedback. The design was crafted to avoid grading biases. Identifying reviewers in the platform aims to increase accountability while a communication channel enhances the ability to learn from each other's ideas.

We evaluated this hypothesis with a controlled, between subject study; the control condition consisting of blind reviewers as is typical among MOOCs today, and the treatment condition using the same mechanism without blinding. Both groups had the same affordances to communicate with anyone in their group. We found that review without blinding led to significantly higher quality feedback and more subsequent communication within the platform.

In this paper, we provide a detailed analysis of the interaction design and evaluation. We relate the impact of this design to the peer assessment in MOOCs. The paper is organized that firstly, we provide a holistic overview of MOOCs' attempts to enhance creativity using existing models of peer assessment. Then we

explain the problems of peer assessment models in detail and introduce our novel interaction design. We then evaluate the proposed designs and present our findings, discussing the impact this approach can bring to the MOOC community in the long term.

II. RELATED WORK

A. Peer Feedback

Feedback improves performance by changing students' locus of attention, focusing them on productive aspects of their work [20, 26]. However, not all peers provide great feedback and some leave only limited comments with no coherent message for improvement, or they provide rogue reviews [35]. Rogue reviews are insufficient reviews caused by laziness, collusion, dishonesty, retaliation, competition, or malevolence [21][35]. To improve this situation, PeerStudio [27] peer assessment system is designed to encourage more feedback comments by showing short tips for writing comments just below the comment box. For example, if a response has no constructive feedback, it may remind students with phrases like: "Quick check: Is your feedback actionable?" by utilizing a word count based heuristic on the entered feedback [27]. Students see such comments as more useful than rubrics when reviewing [22]. Similar techniques are used to improve the quality of product reviews online [19]. Yet, having designed prompts and encouraging peers to provide feedback does not guarantee high feedback quality. In systems such as Peerstudio [27] and Talkabout [24], improvements attributed to feedback designs are minimal [22]. We use an interface design reflecting these lessons by integrating four pointed questions with separate response areas.

B. Peer Interaction and Communication

Evaluating peers work is a great means of learning. In face to face classroom situations peer evaluation often leads to a conversation where both parties interact richly and gain important understandings about the work, through the back and forth communication. Active engagement in reviewing peers' projects may facilitate student learning [5]. MOOCs provide forums for communication and networking; however, they are usually either flooded with unfocused community discussion or no communication at all, they are weeding out paired peer discussions because individual social connections are not readily made.

Social connection and networking are attractive features for improving learning and MOOCs provide a great platform for learners to interact and learn together. Since MOOCs are often open to the public, the diverse nature of students can be an asset for improving learning performance, increasing innovation, creativity and critical thinking rather than negativity [1, 21]. Peers in xMOOCs (university course style MOOCs such as Coursera and Edx) generally only communicate with each other when they participate in forum activities. In the connectivist MOOCs (cMOOCs)[36] approach, peers are learning sources and the connections achieved in the network of diverse participants leads to a richer learning environment. By providing feedback for assignments, projects, and online discussions, cMOOCs lead to a superior learning experience that otherwise cannot be achieved individually by students (or the instructor)

[36]. However, the cMOOC approach requires significant integration and system familiarity, so it is not widespread. Peer assessment is a great way of learning from each other in the community, yet xMOOC designs tend to be so complex that no student can simply choose a peer with whom to communicate and provide feedback. The MOOC design should make explicit mention on the value of peer assistance through communicating commenting and social appraisal. It should provide guidance on "how much" the student should read others' contributions[15]. Our interaction design provides a connection mechanism where peers can communicate and learn directly based on feedback that has been provided to them. Communication leads to interactivity and both parties can understand any concerns or further clarifications. Such discussions and interactions with diverse groups increase the learning significantly [24]. In particular, an HCI course on Coursera encouraged students to post assignment to forums to get feedback, leading to a conversation of feedback with identified peers and to more connectivity with fellow peers. In this HCI MOOC, more than 75% students were in favor of sharing their assignments in public[26], where they assert that blind peer review only drives decreased social connection and the availability of diverse perspectives.

C. Peer Identity

Anonymity is commonly practiced in online and in-person class peer review systems due to the comfort of peers in providing critical feedback [5]. Double blind is used to prevent grading bias mitigate targeted criticism or bullying [4][32]. However, researchers have identified that an important problem in online reviewing is due to increased anonymity and reduced community affiliation [16][29]. Visible identities lead to more constructive feedback than anonymous ones [41]. MOOC peer reviews are typically carried out double blind where peers are not made aware of whom they are reviewing or who has reviewed them. This leads to a rising problem in MOOC assessment where due to increased anonymity, there is reduced accountability and eroded community affiliation [29]. The disadvantage of blind reviews arises in MOOCs when students provide lower quality and less insightful feedback because being anonymous in review, they are not socially accountable. However, unlike most other studies of blind peer assessment in MOOCs, a French online course GdP MOOC reduced the anonymity using a pseudonym as its platform profile. Their students were encouraged to exchange messages via the Canvas platform message system, even only for a "thank you" to their evaluators. Through mmessages, it was possible to ask an evaluator to revisit the assigned grade or to give additional feedback. Although they have no data on messages exchanged on these occasions, the researchers believed that there is much more to gain by fostering social contacts between students than there are risks of conflicts or bias in grading. They found that conflicts between persons are rare and instructor staff can be called upon if student's interactions get sour [2].

D. Open Feedback and Design Studios

The concept of Studios provide an open, shared environment for students to work. The studio model of education was formalized in the Ecole de Beaux-Arts [9]. Although it started with Architecture and Design, the approach was later adopted in product design [28], HCI [14], and software design [40]. In

design studios, the work and the feedback process feedback are all public to the members of the studio. Studio feedback incorporates both formal and informal responses from peers and lecturers. The assessment in design studios allows students to learn the tacit criteria of good design and allows students to learn better from feedback [6]. At the same time the open feedback culture enhances students accountability to provide thoughtful critical feedback. Inspired by the concept of openness leading to more interactions and reviews, IPR is designed in such way that online learners can get feedback from their peers and communicate further on the feedback they got to achieve better understanding and learning.

III. PROPOSED INTERACTION DESIGN FOR PEER REVIEWING

Drawing inspiration from the open feedback mechanism in design studios and cMOOCs open connections, we designed a set of steps of interactions where peers can identify each other and easily communicate around feedback they receive, shown in Fig 1. This framework was built upon components which handle peer identity, provide a rubric to assist in grading, provide samples of constructive feedback, provide four text prompts to promote quality feedback and provide a text field to facilitate communication.

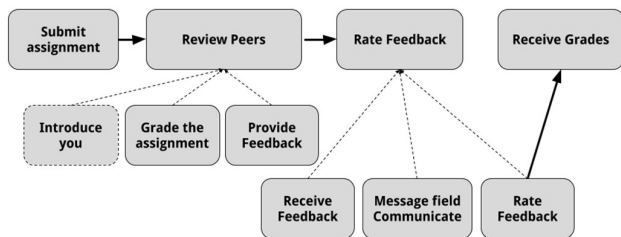


Fig. 1: The proposed interaction design comprises four phases starting with assignment submission to receiving grades. Receiving grades are depended on rating reviews.

The first step of the interaction occurs when students submit assignments. The submitted responses were randomly assigned to students to conduct peer review. Apart from grading and providing feedback, reviewers were needed to provide a short introduction of themselves so the receivers could identify the graders. This identification is not necessarily with platform names, but how the reviewers would like to introduce themselves to their peers. This brought a humanize feeling that the assignment is graded by another responsible peer student. Once the grading (marks) and feedback is submitted, the receivers first receive only the feedback text (not the marks/grade) and will be required to rate the quality of the feedback on a 5-point scale. Optionally, the receiver can reply to the feedback using the message field if there is a disputation or anything of not clear. Each student must review 3 others assignments and rate 3 feedback responses of their own work. Once the receiver rates all 3 feedback forms, it was directed to provide the grades which each peer had assigned. Utilizing the 3 reviews and rating those 3 reviewers normalized the grading biasness and identify good reviewers. Later in a process, these good reviewers could be rewarded to encourage better reviewing eco system. In this section, we explain in detail how these

interaction steps operates and the motivation behind its particular design.

A. Identifiable Peers

We introduced identifiable peers, when most peer grading systems provide anonymous blind peer reviewing. Blind peer reviewing has been used extensively to control the degree of bias in grading, to provide more critical feedback without discomfort to the reviewer or receiver personally. We understood that this situation is different in MOOCs because, those who participate in MOOCs often endorse the network of connections, accountability and diverse learning cultures[12]. Online students are "hungry for social interaction", especially in early MOOCs, discussion forums featured self-introductions from around the world [22]. If it is not using external tools such as Talkabout or social networks, the existing MOOC designs leave very little space to establish connections. To combat social loafing, Kotturi et al [22] propose reversing the diffusion of responsibility by transforming it into a smaller human scale environment. Highlighted co-dependencies in systems show more successful and pro-social behavior [22]. In a peer environment, students are dependent on each other to do their part for the system to work. Encouraging commitment and contribution can help students understand the importance of their participation, and in creating successful peer learning environments [23]. In our interaction design, students were able to see the profile of the graders depending on the introductions they provide. We encouraged students to publish their profile with the statement, "Please introduce yourself to your peer, who are you, where are you from and is there anything special others should know about you, this will encourage them to connect with you to learn better, and will be part of your profile when you provide feedback to your peers". Online classes have limited peer visibility and awareness, so students often feel alone even when surrounded by peers [25]. These humanizing features lead to increase interactions [22].

B. Rubric for Assignment

Teacher designed rubrics are a common way to enable students to peer-grade other students' work. Compared to objective assignments, subjective assignments provide the ability for students to be creative [38]. Yet, grading these assignments is difficult for teachers and novice peers. Rubrics counteract subjectivity during the grading by providing students aids on how to grade other students with teacher-designed categories that communicate the expectations that a piece of work should fulfill. It simply guides students to grade by giving examples of how many points to award for expertise and completeness displayed in the work of a peer [39]. Such directed assessment was found to be more useful and accurate than just guiding students about how to mark. It also enables less knowledgeable students to assess their peers' work [21]. Our interaction design provides rubrics for guiding students and they are provided at the stage when the assignment is published. Revealing rubrics while doing an assignment helps students understand the magnitude of the answers and expectations.

C. Peer Introduction

Introducing peers often takes place in the forums and in the start of a MOOC. At that stage introduction threads are flooded

with students statements of how they would like to introduce themselves. This makes it challenging for most students to initiate more personal social interaction with other students. In cMOOCs, peers establish connections and mutually provide feedback to others. As recommended and envisioned by [33], connecting xMOOC students in a meaningful way to provide feedback as cMOOC, we introduced a step in an interaction design to get peers to introduce themselves to the peer they will grade, opening their identity and humanizing the connection. In Fig. 2 A the interface which collects the introduction information is shown. When grading the assignment (Fig 2 B), the feedback form interface provides the assignment link, Rubric to mark, field to enter marks and importantly the feedback field. The feedback is important in giving marks to describe what worked and hat not worked.

Fig. 2: The interfaces prompt in the reviewing phase. (A) Peer Introduction form where reviewer enter a short introduction so the receiver can see who they are at the feedback rating phase. (B) The interface comes after peer introduction, the 4 field feedback and grade capturing form. This has the peer assignment link and also a link which direct to a sample of a constructive feedback

D. Feedback Form

Peer reviewing allows participants to give more critical feedback and freely express their opinions which in turn results in more useful reviews. Students have shown more interest in the feedback than grades, claiming they learn from that more than doing the assignment [27]. However, the feedback designs are comment boxes which trying capture holistic opinions. In Peerstudio, only 45% of comments are found useful yet there were comments with just phrasings or comments that have no meaning for improvement [27]. At the same time many of the comment fields were left blank due to the time it consumes and in return there are fewer tangible benefits they see [37]. Feedback forms mostly captured fewer words. To increase the feedback, strategic involvement of instructor advising to provide

feedback and humanize phrases showed some improvement of performance [22]. Design features environments in reviews impact on the feedback quality [17]. We design the feedback form which captures many aspects of the reviewers' comments leading to comprehensive feedback. The form has 4 prompts in addition to a grade input (Fig. 2): 1. What worked great? 2. What problems do you see? 3. What didn't you understand? 4. How can this be improved?

Additionally, the feedback form shows the assignment done by the peer and the form has a link to a sample of constructive feedback. Providing such a sample aids novices in identifying and providing the same level of feedback to their peers.

E. Rating Peer Reviewers

Once peers submit the reviews for the assignment, the next step is to rate the feedback they receive from the graders. The peer rating interface as in Fig. 3, has the feedback received from the peers, rating scale and text field to communicate with the peer who provided the feedback. It also shows the introduction provided by the grader to humanize the feedback and convey their identity. The rating is done using a 5-point scale about how much was learned from the feedback. At the same time, the messaging feature provides an interface to connect with feedback provider, helping to further communicate, reducing confusion or establishing further connection.

Fig. 3: The feedback rating interface shows who rated your work and what feedback they gave in answering 4 questions about your submission. You then have the opportunity to evaluate how much you learned from the feedback and provide a textual response to the reviewer.

F. Receiving Grades

Grades were received in the final step after each student reviewing 3 peers work and also rating the 3 peers feedback of their own work. Even though peers provide grades in the review phase, they were not shown to the receivers until after the last phase, which was rating 3 peers feedback. Our design aims to cultivate a feedback focused culture, as opposed to one focused on grades. Therefore, ratings of feedback don't affect the grades they got. Grades given by peers will be visible at the very end of the feedback process. The final grade was the average of the grades received from 3 reviewers. We limited the review mechanism to only 3 peers and not more to facilitate higher quality reviews through a faster overall process. Our aim was to encourage an ecosystem providing great feedback and improving learning through connection and communication.

IV. EVALUATION

We hypothesize that the introducing peers and providing a communication channel will increase feedback quality and lead to more communication than a blind peer review setup. We evaluate this through a between subject experiment using a control condition based on the standard feedback interaction found on MOOCs today and a treatment condition in which our unblinded feedback tool is used.

A. Participants

Since our target audience are open learning environment students, in particular students who take part in xMOOCs, we publicly called for students in that network to volunteer in this experiment. We recruited via a poster in our social networks and our university environments since those carry most of our target audience. Our publicly called Google form had 1128 students registered to participate and they all were well informed about the experiments according to the IRB standards and allowed to withdraw from the experiment whenever they wanted. Similar to a typical xMOOC we had many dropouts in the middle, only 58 completed every step of the experiment. Among those who completed, 21 of them were female and 37 of them were males. Majority of the students age ranged 20-40 years. All participants had experience with online learning and xMOOCs.

B. Materials and Procedure

Participants who registered through an online form were directed to an assignment to complete. Since our focus in not MOOC delivery but peer assessment, we created an assignment with open ended questions in a general interest subject area, in this case "Creativity for everyday life" in which anyone could complete with no prior knowledge. The participants were given 1 week to submit the assignment and it took between 15 and 30 minutes to complete. After completing the assignment they were asked to submit it in a shareable document format such as Google Drive or Dropbox and they were asked to provide a link to their assignment as well as answering a demographic questions through a survey. We handled the logistics by manually using other tools and the interfaces that we created for peer assessment. The assignment had 3 questions: two questions checking attention to a short video about improving creativity and one question requiring the indirect application of what they learned in the video. Of these, one question was entirely subjective, while two others were effective at reflecting diverse experiences of the participants. Once we collected the answers from all the participants, we sent emails giving instructions to log into our study mechanism and conduct at least 3 peer reviews each.

We gave the assignment to all the students who enrolled to the test. Just as in a typical xMOOC, we had substantial attrition (although they enrolled in the test, they did not submit the assignment) and only those who completed the assignment, were sent the invitation to reviewing. In the final stage, out of the remaining 58 students, 29 students were directed to the control condition, an interface which practice blind peer review. In that condition, we provided the feedback form with a single field which is commonly used by edX and Coursera courses. For receivers, we included a feedback rating form without any reviewer introduction, along with the field to communicate with

the reviewer. Another set of 29 students were directed to the treatment condition, an interface using carefully crafted interaction design feedback form interface (Fig. 2), with 4 fields and a feedback rating form (Fig. 3) along with the communication field. In this condition feedback rating form contained reviewers introductions, sharing their identity. Selection and assignment of students for peer review was randomized. Participants were allowed 1 week to do the assignment and 2 weeks to complete the peer review process for both conditions. We measured the feedback rate, feedback quality and whether participants communicated with each other given in the two conditions. Finally we used a closing survey to establish participants experiences in each case.

V. RESULTS

A. How Does Reviewer Blindness Influence Feedback Quality?

Feedback quality in peer review correlates with the number of words in the review, as also shown by [26]. Our participants also reported "Quality" as a subjective 1-5 rating for how helpful reviewers feedback has been [7]. We considered the feedback rates given by the review receivers (the students who received the feedback form in Fig. 2) and also, the number of words in a review feedback in both conditions.

In each condition, students conducted 3 peer reviews which means, they graded 3 assignments, provided feedback for those assignments and rated 3 instances of feedback for their own work, and finally received their grades once every step was completed. The total word count of the feedback comments was 1889 in the control condition and 7208 in the treatment condition. Distribution of the word count in reviews for each student is depicted in Fig. 4. We ran an independent t-test using the control condition and the treatment condition. Students in the control condition had an average feedback quality score of 1.21 out of 29 ($\sigma = .243$), and students in the treatment condition had an average score of 2.43 out of 29 ($\sigma = 1.02$). An unpaired t-test confirmed that students in the treatment condition gave significantly higher quality feedback: $t(58) = 6.24, p = 0.000, \alpha = .05$. Thus, the interaction design had a large positive effect on the usefulness of feedback compared with double-blind peer-reviewing of assignments.

B. Does the Introduced Interaction Design Influence Learners' Discussions?

We analyzed the messages exchanged in both groups in the text field (Message field depicted in Fig. 3, the Feedback form). In the control condition, which did not reflect the introduction of peers but only the message to the reviewer, had 34% of students using the message field during the 1st review, 10% during the 2nd review and 15% in the 3rd review. But in the treatment condition, 55% of students used the message field during the 1st review, 72% during the 2nd review and 62% during the 3rd review, used the message field. Analyzing the word count, the control group exchanged only 35 words in the messages responding to the feedback they received while the treatment condition contained 261. The distribution of word counts for each condition in each review is depicted in Fig. 5.

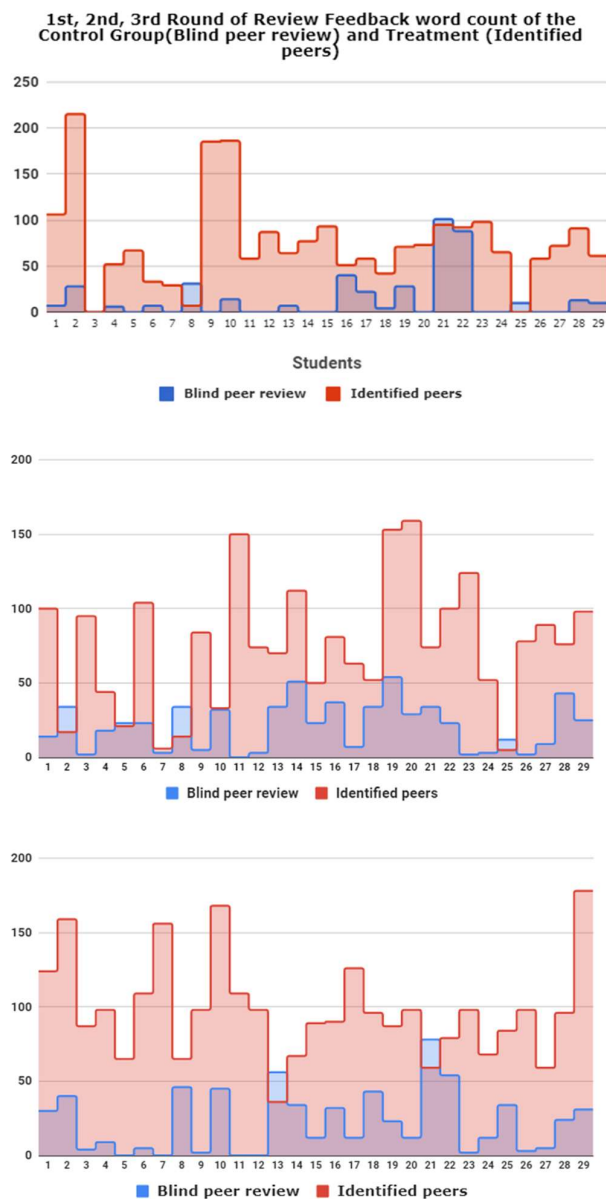


Fig. 4: Comparison of the word count in the feedback received in reviews in control and treatment conditions.

C. How Does Designed Interaction Influence Student Grades?

We analyzed the final grades of the two conditions. First, we calculated the average of 3 reviews that each student received and compared those across the control and treatment conditions. Fig. 6 depicts the box plots in two conditions. An independent t-Test comparing of the final grades of the two groups had a p value = .611 for a 95% confidence interval for the difference (-1.0456 , 1.3896) and t-value 0.2835 resulting no significant difference to the grades on each group. However we gave a closing survey to the treatment group and focused on 3 questions. Does being identifiable increase your interest in reviewing? 73% of respondents thought being identifiable had a

useful effect. Did you get useful feedback? 69% of participants said they learned something from the feedback they were given. Are you satisfied with your reviews? 77% were actively satisfied.

Word count of Messages in Identified Peer Review and Blind Peer Review

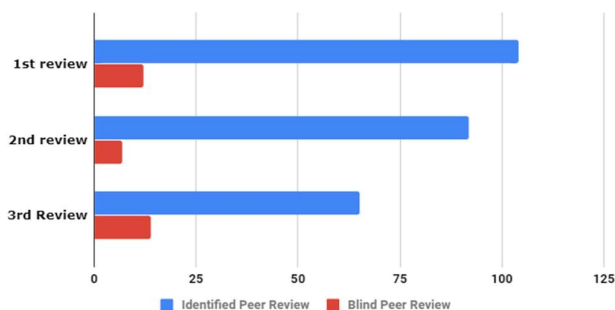


Fig. 5: Numbers of exchanged messages in the control and treatment conditions.

VI. DISCUSSION AND FUTUREWORK

The introduced interaction design provided quality feedback and increased the communication compared to blind peer reviews which did not have a four section feedback forum or expose reviewer identity. As stated in the research [17], framing the feedback design review environment increased feedback quality. We believe the high quality feedback in the treatment condition is due to the design of the feedback form which aid in capturing meaningful responses, even though we believe many students were novice to providing critical feedback. However, in this experiment, we did not find any significant difference in grades by using the identified peer grading with messaging. This is somewhat expected as learners were not given a chance to resubmit their work. However, this result does demonstrate that adding identity of reviewers does not lead to grading bias in this case.

There are calibrated peer review techniques which increase the accuracy of peer reviews [34]. However, there is limited prior work in calibrating the feedback quality. Although our design did not directly calibrate the students, yet it aided students by providing an example of good feedback. At the same time recent research revealed that no correlation exists between the quality of students' assignment and note writing and the usefulness of receiving peer feedback. Yet, their results suggest that students were engaged in discussions and advanced their understanding. They produced a large number of explanations and knowledge building discourse, all of which involved knowledge advancement in each week [18]. Similarly, we found that students in the treatment condition engaged more in knowledge building by starting conversations over the feedback made by peers.

While running the experiment, we learned that students had not been exposed to identified peer grading before in any of the online courses. In other words, every review they have done were blind in peer assessing during the MOOCs they have

participated. In the treatment condition, we found students introduce themselves to peers in a variety of ways, such as very basic details (name, university, batch), to more personal interests such as wanting to meet new co-learners, or participate in networking, volunteering and other projects. This triggered some students to communicate and network with each other, which can be a significant contributor to learning success [36, 11].

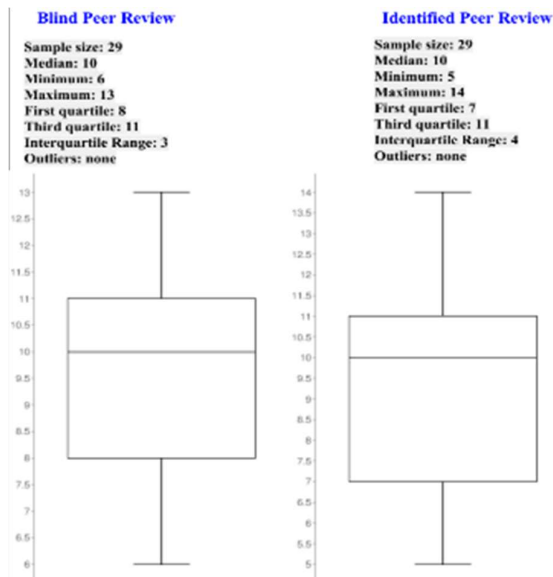


Fig. 6: Comparison of the Blind review group and Identified review group students' average grades in 3 peer reviews which reflect no significance

At the same time, we observed that in the control condition, messages did not contain meaningful communication while the treatment condition had students interested in further communicating together. For example, control case messages were limited to one or two words such as "Thanks, OK" while the treatment groups had messages like "I like to network too, it is great to be connected to new one, thanks for the advice. KIT". We believe this communication was triggered due to the quality feedback they received and also knowing the identity of the peer providing it. At the same time the message box gave students a chance to revert any question they had about their feedback, such as a student's repairing the assignment link again after being informed in the feedback that the reviewer couldn't the access to the submission. Although the introduced design increased the feedback quality to some extent, we believe further improvements such as tuning the reviewer assigning rather than following random approaches, proving incentives to quality feedback contributors [37] will encourage the reviewers even more. Since the MOOC model has changed lately with continuous enrollments and self-paced courses, forum activity in MOOCs has reduced tremendously [8]. Interaction and networking through peer assessment shown great potential in keeping the learner's attention in learning by diverse community. This research opens up an untouched area of peer reviewing, which is identity. Peer reviews kept blind in close

eLearning for decades, yet our argument is that MOOC identity is opening a window of networking rather the this is designed such that it requires the reviewer to grade first and next rate the feedback they received and then reveal the marks to reduce the grading bias. Shared identity has shown great value as a triggering point to have a direct connection with a cause, in this case, discussion about the assignment and the submission. Students were indicating the requirement of more communication methods such as chat or video to conduct synchronous communications.

Another opportunity for exploration could be the most impactful answers to be visible to all participants so everyone can learn from those as a benchmark. Inspired by the design studio concept where learners share the work publicly with a group and it is open for criticism and adjustments are made with early feedback [33], the set of peers could also provide early feedback on the assignment and later count the final grades depending on the average of the peers.

A. Limitations

This experiment was done without using a full MOOC environment which typically has an enrollment stage, video lecturers, forums and assignments. We have provided stimulated interface to upload their assignment answers and peer review interfaces. Peer assignments were done manually and were sent unique link to each student to review based on the assigned peer.

VII. CONCLUSION

Understanding peer reviewing effects is particularly compelling for online learning platforms as they aim to scale for global audiences. In order to achieve such scale, these learning environments will often need to function algorithmically and independently of instructor oversight. In such a design, peer feedback, rating and communication links with identity may be an optimal solution given that other peer assessment mechanisms often fails to provide the required level of quality feedback. We have introduced an interaction design allowing the *identification of peers* with *designed feedback* and *message field* improving performance of peer assessment for MOOCs. Our experiment results proved that having such interventions lead to quality feedback and increased communication. We show that this mechanism leads to improved quality feedback with no significant difference in grades. Our hope is this line of work can improve the global effects of xMOOCs where peers learn and network while providing quality feedback, leading to a culture of networked and active learning.

REFERENCES

- [1] W. Admiraal, B Huisman, and M Van de Ven. 2014. Self-and peer assessment in massive open online courses. *International Journal of Higher Education* 3, 3 (2014), p119.
- [2] R. Bachelet, D Zongo, and A Bourelle., "Does peer grading work? How to implement and improve it? Comparing instructor and peer assessment in MOOC GdP". *Proceedings European MOOCs Stakeholders Summit*, pp.224., 2015.
- [3] S. P. Balfour. "Assessing writing in MOOCs: Automated essay scoring and calibrated peer review", *Research & Practice in Assessment* 8, 2013.
- [4] S. Bayne and J. Ross. "The Pedagogy of the Massive Open Online Course (MOOC): the UK View", *The Higher Education Academy*. 2013.
- [5] S. Bostock, "Student peer assessment". *Learning Technology*, 2000.

- [6] L. Bouzidi and A. Jaillet, "Can online peer assessment be trusted?" *Journal of Educational Technology & Society*, 12, 4 2009.
- [7] S. Brown, P Race, and C Rust. "Using and experiencing assessment", *Assessment for learning in higher education* 1995, p75–85.
- [8] Class Central. "MOOC Trends in 2016: MOOCs No Longer Massive." (2016). Available: <https://www.class-central.com/report/moocs-no-longer-massive/>.
- [9] R. Chafee and A Drexler. "The Architecture of the Ecole" Des Beaux-Arts. Secker and Warburg.
- [10] R. Lu and L Bol. "A comparison of anonymous versus identifiable e-peer review on college student writing performance and the extent of critical feedback". *Journal of Interactive Online Learning* 6, 2, pp.100–115.2007.
- [11] S. Downs. "MOOC–Diversity and Community in Online Learning". Keynote presentation delivered to 26e Entertains Jacques Cartier, Lyon, France. 2013.
- [12] D. Gamage, S. Fernando, and I. Perera. "Factors leading to an effective MOOC from participants perspective". In *Ubi-Media Computing (UMEDIA), 8th International Conference on. IEEE*, pp. 230–235, 2015.
- [13] D. Glance, M Forsey, and M Riley., "The pedagogical foundations of massive open online courses". *First Monday*, 18, 5 2013.
- [14] S. Greenberg, "Embedding a design studio course in a conventional computer science program". In *Creativity and HCI: From experience to design in education. Springer*, pp.23–41, 2009.
- [15] L. Guàrdia, M. Maina, and A. Sangrà. 2013. "MOOC design principles: A pedagogical approach from the learner's perspective". *eLearning Papers* 33, 2013.
- [16] J. Hamer, K. TK Ma, and H. F. Kwong. "A method of automatic grade calibration in peer assessment", Volume 42. Australian Computer Society, Inc., pp.67–72.2005.
- [17] C. M. Hicks, V Pandey, C A Fraser, and S Klemmer, "Framing Feedback: Choosing Review Environment Features that Support High Quality Peer Assessment". In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems. ACM*, pp.458–469, 2016.
- [18] J. Jiao, Y. Yang, H. Zhong, and G. Ren. 2017. "Improving Learning in MOOCs Through Peer Feedback: How Is Learning Improved by Providing and Receiving Feedback?". In *Learning and Knowledge Analytics in Open Education. Springer*, 69–87.
- [19] S. Kim, P. Pantel, T. Chklovski, and M. Pennacchiotti, "Automatically assessing review helpfulness". In *Proceedings of the Conference on empirical methods in natural language processing. Association for Computational Linguistics*, pp. 423–430, 2006.
- [20] A. N. Kluger and A. DeNisi. "The effects of feedback interventions on performance: a historical review, a meta-analysis, and a preliminary feedback intervention theory". *Psychological bulletin*, 119, 2, pp. 254–263. 1996.
- [21] L. V. Knight and T A Steinbach, "Adapting peer review to an online course: An exploratory case study". *Journal of Information Technology Education* 10 (2011), pp. 81–102, 2011.
- [22] Y. Kotturi, C. Kulkarni, M. S. Bernstein, and S. Klemmer, "Structure and messaging techniques for online peer learning systems that increase stickiness". In *Proceedings of the Second (2015) ACM Conference on Learning@ Scale. ACM*, pp. 31–38. 2015.
- [23] R. E. Kraut, P. Resnick, S. Kiesler, M. Burke, Y. Chen, N. Kittur, J. Konstan, Y. Ren, and J. Riedl., "Building successful online communities: Evidence-based social design", MIT Press. 2014
- [24] C. Kulkarni, J. Cambre, Y. Kotturi, M. S. Bernstein, and S. Klemmer. "Talkabout: Making distance matter with small groups in massive classes". In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing. ACM*, pp.1116–1128. 2015.
- [25] C. Kulkarni, Y. Kotturi, M. S. Bernstein, and S. Klemmer., "Designing Scalable and Sustainable Peer Interactions Online". In *Design Thinking Research. Springer*, pp.237–273, 2016.
- [26] C. Kulkarni, K. Pang Wei, H. Le, D. Chia, K. Papadopoulos, J Cheng, D Koller, and S R Klemmer, "Peer and self assessment in massive online classes". In *Design thinking research. Springer*, pp.131–168, 2015.
- [27] C Kulkarni, M S Bernstein, and S R Klemmer. "PeerStudio: rapid peer feedback emphasizes revision and improves performance". In *Proceedings of the Second ACM Conference on Learning@ Scale. ACM*, 75–84. 2015.
- [28] B. Lawson. "How designers think: The design process demystified". Routledge., 2006.
- [29] R. Lu and L Bol."A comparison of anonymous versus identifiable e-peer review on college student writing performance and the extent of critical feedback". *Journal of Interactive Online Learning* 6, 2 100–115. 2007.
- [30] J. Mackness, M. Waite, G. Roberts, and E. Lovegrove., "Learning in a small, task-oriented, connectivist MOOC: Pedagogical issues and implications for higher education". *The international review of research in open and distributed learning* 14, 4, 2013.
- [31] A. Margaryan, M. Bianco, and A. Littlejohn. "Instructional quality of massive open online courses (MOOCs)". *Computers & Education* 80 ,77–83, 2015.
- [32] P. Orsmond, S. Merry, and K. Reiling."The importance of marking criteria in the use of peer assessment". *Assessment & Evaluation in Higher Education* 21, 3 pp. 239–250.1996.
- [33] R. O'Toole, "Pedagogical strategies and technologies for peer assessment in Massively Open Online Courses (MOOCs)", 2013.
- [34] K. Raman and T. Joachims, "Methods for Ordinal Peer Grading". In *Proceedings of the 20th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD '14). ACM*, New York, NY, USA, pp. 1037–1046, 2014, DOI: <http://dx.doi.org/10.1145/2623330.2623654>
- [35] K. Reily, P. L. Finnerty, and L. Terveen, "Two peers are better than one: aggregating peer reviews for computing assignments is surprisingly accurate". In *Proceedings of the ACM International conference on Supporting group work. ACM*, 115–124. 2009.
- [36] G. Siemens,"Connectivism: Learning as network-creation". *ASTD Learning News* 10, 1 2005.
- [37] T. Staubitz, D. Petrick, M. Bauer, J. Renz, and C. Meinel. "Improving the Peer Assessment Experience on MOOC Platforms". In *Proceedings of the Third ACM Conference on Learning@ Scale. ACM*, pp. 389–398. 2016.
- [38] H. K. Suen. "Peer assessment for massive open online courses (MOOCs)." *The International Review of Research in Open and Distributed Learning*, 15, 3, 2014.
- [39] G. L. Taggart, S. J. Phifer, J. A. Nixon, and M. Wood, "Rubrics: A handbook for construction and use". *R&L Education*. 1999.
- [40] J. E. Tomayko. "Teaching software development in a studio environment". In *ACM SIGCSE Bulletin*, Vol. 23. ACM, 300–303. 1991.
- [41] S. Vinther, O. Nielsen, J Rosenberg, N Keiding, and T V Shroeder. "Same review quality in open versus blinded peer review in" *Ugeskrift for Læger*", *Dan Med J* 59, 8, 2012