

The Effect of Peer Assessment Rubrics on Learners' Satisfaction and Performance Within a Blended MOOC Environment

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Abstract: Massive Open Online Courses (MOOCs) have a remarkable ability to expand access to a large scale of participants worldwide, beyond the formality of the higher education systems. MOOCs support participants to be actively involved in collaborative learning and construct their own learning experience in a variety of domains. However, one of the biggest challenges facing MOOCs is how to assess the learners' performance in a massive learning environment beyond traditional automated assessment methods. To address this challenge, peer assessment has been proposed as an effective assessment method in MOOCs. The problem is, however, how to ensure the quality of the peer assessment in terms of validity and reliability. Moreover, assessment in blended MOOCs (bMOOCs) introduces unique challenges regarding the best peer assessment model in a learning environment that brings together face-to-face interactions and online activities. This paper presents the details of a study conducted to investigate peer assessment in bMOOCs. The study results show that flexible rubrics have the potential to make the feedback process more accurate, credible, transparent, valid, and reliable, thus ensuring the quality of the peer assessment task.

1 INTRODUCTION

Massive Open Online Courses (MOOCs) have succeeded in offering large amount of university level courses for a huge number of participants around the globe without any entry requirements or tuition fees, regardless of their location, age, income, ideology, and education background (Yousef et al., 2014a). Different types of MOOCs have been introduced in the MOOC literature. Daniel (2012) and Siemens (2013) classified MOOCs into connectivist MOOCs (cMOOCs) and extension MOOCs (xMOOCs). The vision behind cMOOC is based on the theory of connectivism, which fosters connections, collaborations, and knowledge sharing among course participants. The second type, xMOOCs is following virtue of behaviorism and cognitivist theories with some social constructivism aspects. xMOOC platforms were developed by different elite universities and usually distributed through a third party provider such as Coursera, edX, and Udacity.

Despite their popularity and the large scale participation, a variety of concerns and criticism in the use of MOOCs have been raised. Yousef et al. (2014a) in their comprehensive analysis of the MOOC literature reported that the major limitation in MOOCs is the lack of human interaction (i.e. face-to-face communication). Furthermore, the authors pointed out that the original concept of MOOCs that aims at breaking down the barriers of education for anyone, anywhere, and at any time, is far away from the reality. In fact, most of the existing (x)MOOC implementations still follow a centralized and controlled top-down, teacher-centered learning model. Initiatives to implement student-centered, open, bottom up, and distributed forms of MOOCs are the exception rather than the rule. Other researchers point out concerns about the limitations of MOOCs. These concerns include pedagogical problems concerning providing the participants with timely, accurate, and meaningful feedback of their assignments tasks (Hill, 2013; Piech et al., 2013; Luo et al., 2014); lack of

interactivity between learners and the video content (Grünewald et al., 2013); high drop-out rates, on average 95%, of course participants (Daniel, 2012). Plausible reason for the latter problem might be the complexity and diversity of the participants. This diversity is not only related to cultural and demographic attributes, but also takes into account individual motives and perspectives when enrolled in MOOCs (Yousef et al., 2015b).

In order to address these limitations, a new design paradigm emerges, called blended MOOCs (bMOOCs). This paradigm aims to bring together in-class (i.e. face-to-face) interactions and online learning components as a blended environment. This blended model can resolve some of the hurdles facing standalone MOOCs (Ostashewski & Reid, 2012; Bruff, et al., 2013). The bMOOCs model has the potential to bring human interactions into the MOOC environment, foster student-centered learning, support the interactive design of the video lectures, provide effective assessment and feedback, as well as contemplate the diverse perspectives of the MOOC participants.

However, the ability to evaluate a large scale of participants in MOOCs is obviously a big challenge (Yin and Kawachi, 2013). The most widely used evaluation technique in MOOCs is regular automated assessment, which is restricted to closed question formats, e.g. quizzes with multiple choice questions (Diez et al., 2013; Kaplan & Bornet, 2014). This method of assessment is relatively easy to apply in science curricula courses, even though the level of competences to be examined is rather limited. It seems even more difficult to apply this assessment method in humanities curricula courses, mainly due the nature of these courses, which are based on the creativity and imagination of the learners (Sandeen, 2013). This provides strong ground for alternative assessment methods for both domains that provide effective and constructive feedback to MOOCs participants about their open-ended exercises, or essays.

The generic aim of most assessment methods is to provide such kind of feedback usually involve teaching staff correcting and grading the assignments. In the MOOCs scenarios, this requires substantial resources in terms of time, money, and manpower. To alleviate this problem, we argue that the most suitable way is to look for assessment methods that employ the wisdom of the crowd. Such assessment methods include portfolios, wrappers, self-assessment, group feedback, and peer assessment (Chatti et al., 2014; Davis et al., 2014).

Learner's portfolio is an approach to authentic assessment that potentially enables large classes to reflect on their work (McMullan, 2003); wrapping assessment techniques use a set of reflective questions to engage participants in self-assessment and self-directed learning (Yorke, 2007); self-assessment can be used to prompt learners' reflection on their own learning outcomes; and peer assessment refers crowdsourcing grading activities where learners can take responsibility for rating, evaluating, and providing feedback on each other's work (Topping, 1998).

We considered these different crowdsourcing assessment activities, and concluded that the most suitable assessment method in our scenario is to involve the learners themselves under supervision and guidance from the teachers. We think that peer assessment activities that involve learners themselves in the assessment process can play a crucial role in supporting an effective MOOC experience. So far, little research has been carried out to investigate the effectiveness of using peer assessment in a bMOOC context (Chatti et al., 2014; Suen, 2014). In an attempt to handle this assessment issue, this paper presents in details a study conducted to investigate the effectiveness of using peer assessment on learners' performance and satisfaction in the bMOOC environment L²P-bMOOC.

2 L²P-BMOOC: FIRST DESIGN

As highlighted earlier, current MOOCs suffer from several critical limitations, among which are the focus on the traditional teacher-centered model, the lack of human interaction, as well as the lack of interaction between learners and the video content (Grünewald et al., 2013; Yousef et al., 2015b).

L²P-bMOOC is an extension of the L²P learning platform of RWTH Aachen University, Germany. It was designed and implemented to address these limitations. L²P-bMOOC supports learner-centered bMOOCs by providing a bMOOC environment where learners can take an active role in the management of their learning activities, thus harnessing the potential of bMOOCs to support self-organized learning. L²P-bMOOC fosters human interaction through face to face communication and scaffolding, driven by blended learning approach. The platform includes a video annotation tool that enables learners' collaboration and interaction

around a video lecture to engage the learners and increase interaction between them and the video content. Thus, L²P-bMOOC changes the traditional MOOC concept, where learners are limited to viewing video content towards a collaborative and dynamic one. Learners are encouraged to organize their learning, collaborate with each other, create and share their knowledge with others.

In L²P-bMOOC, video lectures are collaboratively structured and annotated in a mind-map representation. Figure 1 shows the workspace of L²P-bMOOC which consists of a course selection section, an unbound canvas representing the video map structure of the lecture, and a sidebar for new video node addition and editing of video properties. Possible actions on a video node include video annotations, video clipping, social bookmarking (i.e. attaching external web feeds), and collaborative discussion threads (Yousef et al., 2015c).

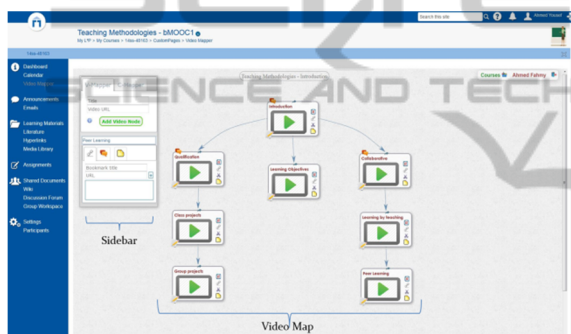


Figure 1: L²P-bMOOC Workspace.

As pilot test for this platform the course “Teaching Methodologies” was delivered as bMOOC by the Fayoum University, Egypt in cooperation with RWTH Aachen University. It started in March 2014 and ran for eight weeks. This course was offered both formally to students from Fayoum University and informally with open enrollment to anybody who was interested in teaching and learning methodologies. At the end of the course, there were 128 active participants. 93 were formal participants who took the course to earn credits from Fayoum University. These participants were required to complete it and obtain positive grading of assignments. The rest were informal participants undertaking the learning activities at their own pace without receiving any credits. The teaching staff provided six video lectures and the course participants have added 27 related videos. The course was taught in English and the participants were encouraged to self-organize their learning environments, to present their own ideas, collaboratively create video maps of the lectures,

and share their newly-acquired knowledge through social bookmarking, annotations, forums, and discussion threads (Yousef et al., 2015c).

To evaluate whether the platform supports and achieves the goals of “network learning” and “self-organized learning”, we designed a qualitative study based on a questionnaire. This questionnaire utilized a 5-point Likert scale with range from (1) strongly disagree, to (5) strongly agree. We derived the results and reported conclusions based on the 50 participants who completed and submitted the questionnaire by the end of the survey period. The results obtained from this preliminary analysis are summarized in the following points:

The collaboration and communication tools (i.e. group workspaces, discussion forums, live chat, social bookmarking, and collaborative annotations) allowed the course participants to discuss, share, exchange, and collaborate on knowledge construction, as well as, receive feedback and support from peers.

The results further show that the majority agreed that L²P-bMOOC allowed them to be self-organized in their learning process. In particular, the participants reported that it helped them to learn independently from teachers and encouraged them to work at their own pace to achieve their learning goals.

The study, however, identified two problems concerning assessment and feedback. The participants had some difficulties in tracking and monitoring their learning activities and those of their peers. The second issue pointed out was the limited ability to evaluate and give effective feedback for their open-ended exercises (Yousef et al., 2015c).

A possible solution for the first problem was the introduction of learning analytics features. These features can improve the participants’ learning experience through e.g. the monitoring of their progress and supporting (self)-reflection on their learning activities. To alleviate the second problem, we opted for peer assessment. As motivated in the previous section, one possible scenario for peer assessment is the evaluation of assignment that cannot be corrected automatically, such as open-ended exercises and essays.

In August 2014, we conducted a second case study to evaluate the usability and effectiveness of the learning analytics module. The focus of this study was to examine to which extent this module supported personalization, awareness, self-reflection, monitoring, and recommendation in bMOOCs (Yousef et al., 2015a). What still remained unclear is how to leverage peer assessment in

bMOOCs. In this paper, we investigate the application of peer assessment in bMOOCs. We address the following research questions:

- Does the peer assessment module *improve learning outcomes*?
- Does the peer assessment module provide a *reliable and valid feedback* for participants?
- Which *peer assessment model* fits best in a bMOOC context?
- What is the learners' perception of satisfaction with the *usability* of the peer assessment module in L²P-bMOOC?

3 PEER ASSESSMENT IN MOOC

Assessment and feedback are essential part of the learning process in MOOCs. Collecting valid and reliable data to grade learners' assignments; identifying learning difficulties and taking action accordingly; and using these results, are just a portion of the measures to improve the academic experience (Kulkarni et al., 2013). Many MOOCs use automated assessments (e.g. quizzes with closed questions such as multiple-choice/multiple-response) which strongly focus on the cognitive aspects of learning. The key challenge of automated grading in MOOCs is the inability to capture the semantic meaning of learners' answers; in particular on open-ended questions (Kulkarni et al., 2013).

On the other hand, peer assessment is a promising alternative evaluation strategy in MOOCs, where learners can be actively involved in the assessment processes (O'Toole, 2013). This method of assessment is suitable for activities, like exercises, assignments, or exams which do not have clear right or wrong answers especially in humanities, social sciences, and business studies (O'Toole, 2013). Several studies have been conducted to investigate the pedagogical impact of using peer assessment in traditional classroom instruction, and acknowledged a number of distinct advantages. These include: increase in learners' responsibility and autonomy, new learning opportunities for both sides (i.e. givers and receivers of work review), enhanced collaborative learning experience, and strive for a deeper understanding of the learning content (Topping, 1998).

Unfortunately, so far, there has been little discussion about using peer assessment in MOOCs. In the next section, we will discuss specifically how MOOCs providers are using peer assessment in their courses.

3.1 Coursera

Coursera has integrated a peer assessment system in its learning platform to evaluate and provide feedback for at least 3 to 4 assignments. Coursera provides learners with an optional evaluation matrix to improve peer assessment results. In addition, learners have the opportunity to self-evaluate themselves (Piech et al., 2013; Luo et al., 2014). The peer assessment system in Coursera involves three main phases: 1) submission phase, 2) evaluation phase, and 3) publishing results (Coursera, 2015). Until recently, there has been no reliable evidence on how peer assessment affects the learning experience in Coursera.

In several MOOCs offered by the Pennsylvania State University and hosted online by Coursera, learners reported that, they mistrusted the peer assessment results. Moreover, they outlined some issues of peer assessment, such as the lack of peers' feedback, accuracy, and credibility (Suen, 2014).

3.2 edX

Peer assessment in edX work similar to the ones in Coursera. Here, learners are required to review a few assignments samples that have already been graded by the professor before evaluating their peers. After learners proved that they can assign grades similar to those given by the professor, they are permitted to evaluate each other's work and provide feedback, using the same rubric (edX, 2015).

3.3 Peer Assessment Issues in MOOCs

Peer assessment is a valuable evaluation method for learners to receive deeper feedback on their assignments but it is not always as effective as expected in MOOCs scenarios (Suen, 2014). Jordan (2013) shows that MOOCs which used peer assessments tend to have lower course completion rates compared to the ones that used automated assessment. In general, there are several possible factors that can explain the lack of effectiveness of peer assessment in MOOCs:

- The issue of scale (Suen, 2014).
- The diversity of reviewers' background and prior experience (Yousef et al., 2015b).
- The lack of accuracy and credibility of peer feedback (Suen, 2014).
- The lack of transparency of the review process.
- MOOCs participants do not trust the validity and reliability of peer assessment results due to

the absence of a clear evaluation authority (e.g. teacher)

- The low perceived expertise (McGarr & Clifford, 2013).
- Peer assessment in MOOCs employs fixed grading rubrics. Obviously, different exercise types require different assessment rubrics (Sánchez-Vera & Prendes-Espinosa, 2015).

4 PEER ASSESSMENT IN L²P-BMOOC

In this study, we focus on the application of peer assessment from a learner’s perspective to support self-organized and network learning in bMOOCs through peer assessment rubrics. In the following sections, we discuss the design, implementation, and evaluation of the new peer assessment module in L²P-bMOOC.

4.1 Requirements

In order to enhance L²P-bMOOC with a peer assessment module, we collected a set of requirements from recent peer assessment and MOOCs literature (Gielen et al., 2010; Suen, 2014; Yousef et al., 2014a). Then, we designed a survey to collect feedback from different MOOC stakeholders concerning the importance of the collected requirements. The demographic profile of this survey was distinguished into professors and learners as follows:

- Professors: 98 professors who had taught a MOOC completed this survey. 41% from Europe, 42% from the US and 17% from Asia.
- Learners: 107 learners participated in the survey. A slight majority of these learners were males (56%). The learners’ ages ranged from 18 to 40+, with almost 65% between the ages of 18 and 39. 12% High school and other levels of studying, 36% were studying Bachelor, 40% Master’s, 12% PhD. All of them had taken one or more online courses, and 92% had participated in MOOCs. These learners came from 41 different countries and cultural backgrounds in Europe, US, Australia, Asia, and Africa.

A summary of the survey analysis results are presented in Table 1. The agreeability means of peer assessment requirements is quite high at above 4. In particular, indicators 3 and 5 call for specific, albeit flexible guidelines and rubrics. This is important to

avoid grading without reading the work, or not following a clear grading scheme, which negatively impacts the quality of the given feedback (Yousef et al., 2014b).

Table 1: L²P-bMOOC Peer Assessment Requirements (N=205).

No	L ² P-BMOOC Peer Assessment Requirements		
	Items	M	SD
1	Students should receive feedback and/or correct answers to each assignment task.	4.57	0.90
2	Provide formative assessment and feedback within the learning process.	4.12	1.05
3	Design flexible guidelines and rubrics for each task.	4.53	0.84
4	Give clear directions and time limits for in-class peer review sessions (i.e., face-to-face interaction) and set defined deadlines for out-of-class peer review assignments.	4.36	1.06
5	Each student doing the peer review should explain his or her evaluation.	4.32	0.79

1. Strongly disagree ... 5. Strongly agree

Based on the peer assessment literature review and the survey results, we derived a set of requirements to support peer assessment in L²P-bMOOC, as summarized below:

- **User Interface:** The interface should be simple, understandable, and easy to use while requiring minimal user input. The interface design of the module should take usability principles into account, and go through a participatory design process (Nielsen, 1994).
- **Rubrics:** Provide learners with flexible task-specific rubrics that include descriptions of each assessment item to achieve fair and consistent feedback for all course participants.
- **Management:** Peer assessment should be easy to manage. The module ought to be integrated into the platform with features for activation and deactivation.
- **Scalability:** The fundamental difference between MOOCs and traditional classroom is the scale of learners. Consequently, scalability should be considered in the implementations of peer assessment module in L²P-bMOOC.
- **Collaborative Review:** Provide mechanisms for a collaborative review process which involves the input of more than one individual participant.

- **Double Blind Process:** Peer assessment module should support the double blind review process. Neither the assignment authors know the reviewers identities, vice versa.
- **Deadlines:** Peer assessment module should provide two deadlines for each task: the submission deadline for learners to submit their work, and the other for the peer grading phase.

5 IMPLEMENTATION

The peer assessment module in L²P-bMOOC consists of the six components as shown in Figure 2.

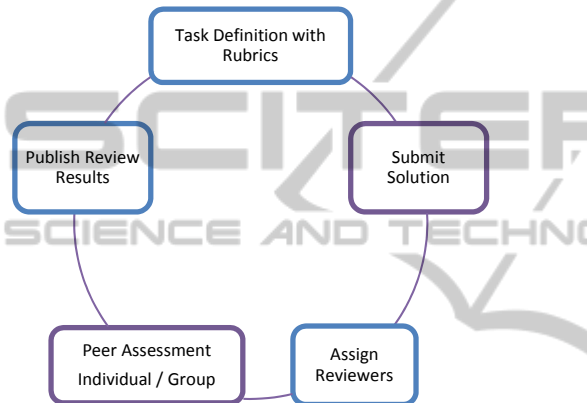


Figure 2: Peer assessment workflow.

These peer assessment components are classified according to the following methods:

- Teachers need methods to define assignment tasks and manage the review process.
- Learners need methods to see assignment tasks and submit solutions, as well as, to provide and receive peer reviews.

Microsoft SharePoint 2013 has been used as the underlying technology of the L²P platform. SharePoint offers a solid base for MOOCs development, while offering a wide range of other advantages. These include scalability, security, customization and collaboration. The internal list structure of SharePoint makes it easy to implement fine grained rights on individual list items, which allow for easy to use rights management in L²P-bMOOCs peer assessment module. Basically, it is easy to configure who can see what on a given point in time. Also, workflows can be used to organize submission and evaluation processes.

5.1 Teacher Perspective

The peer assessment module in L²P-bMOOC

consists of a centralized place of actions (navigation ribbon) to help teachers to define, manage, and navigate the assignment tasks, as shown in Figure 3.



Figure 3: Teacher Navigation Ribbon.

The ribbon actions provide a complete set of tools to define peer assessment tasks, manage task-specific rubrics, assign reviewers, give final grades, and publish the results.

5.1.1 Task Definition with Rubrics

The task definition begins with defining some basic attributes of the assignments. These attributes include the name and description, the deadlines, and the associated materials and resources. Additionally, there are a number of specific settings to be configured, which are related to the peer assessment itself. These specific settings are concerning the start and end of the review, the review impact on the final grade, and the task-specific rubrics (see Figure 4).

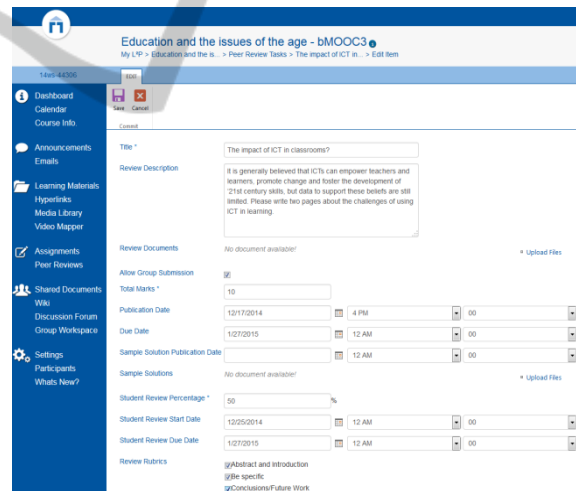


Figure 4: Task Definition with Rubrics.

There are well researched and documented methods to enhance the effectiveness of peer assessment by asking direct questions for the peer to answer, in order to assess the quality of work by the author (Gielen et al., 2010). This way, the reviewer can easily reflect on the quality of work in a goal-oriented manner. Hence, we implemented a rubric system that allows tutors to define specific questions related to each task, and also reuse pre-defined rubrics. The process for defining rubrics is included in the task definition itself. A typical rubric has two

attributes: name and the actual rubric question. Further, it contains descriptions that define the learning outcome and performance levels to provide enough information to guide learners in doing the peer assessment review. Teachers can select multiple rubrics to associate with an assignment definition.

Once the assignment task has been defined, an automated workflow takes care of publishing the assignment at the specified time along with submission deadline. Meanwhile, another workflow takes care of the review submission after the review start date.

5.1.2 Assigning Reviewers

Course teachers can assign solutions submitted by learners to different peers for reviewing by selecting from a list (see figure 5).

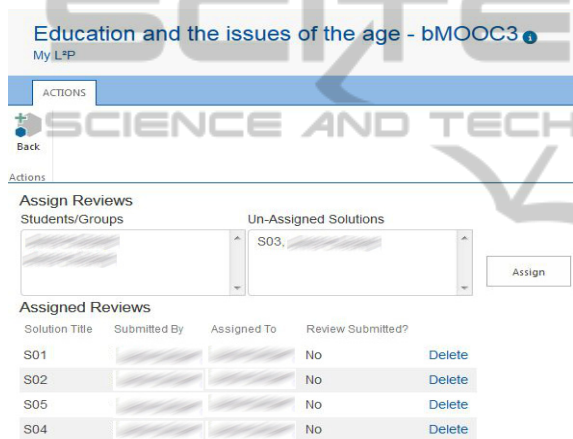


Figure 5: Assigning Reviewers.

Future versions of the system should automate the distribution process. There are mechanisms to reverse the process, if there is a problem or a mistake. After this, the assigned reviews are visible to the learners according to the specified dates, and if any review assignment is made after the review start date, it would be shown to the learners directly.

5.1.3 Publishing Reviews

After grading all the solutions, teachers can publish the review results to the learners at once using an action from the ribbon. As a result, the learners are able to see the reviews submitted by their peers.

5.2 Learner Perspective

The navigation ribbon contains actions for learners to submit solutions and perform peer review task.

5.2.1 Submitting Solutions

Once the assignment has been published, the learners can see the details of the assignment and work on their solutions until the proposed deadline. Learners can add a solution by adding a description and uploading their documents and resources relevant to the solution. Learners can work individually, or in groups, depending on the assignment's requirements (see Figure 6).

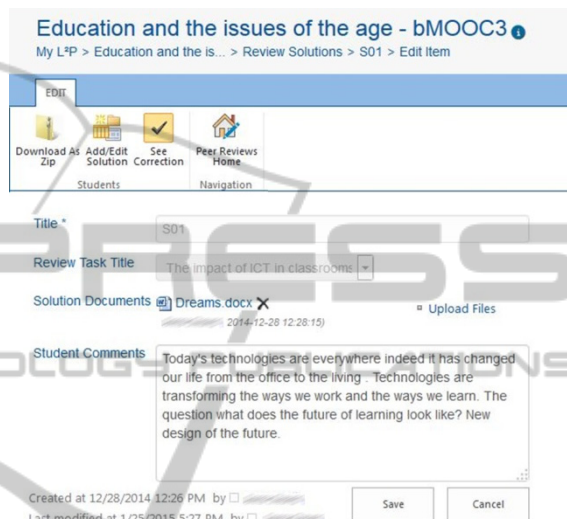


Figure 6: Submitting Solutions.

5.2.2 Peer Assessment

There are a number of peer assessment methodologies dealing with the anonymity of author and reviewer, e.g. Single Blind Review (reviewer is anonymous, author is known), Double Blind Review (both reviewer and author are anonymous) and lastly the Open Review (No anonymity). For the purpose of this implementation we decided to use the Double Blind Review, as it reduces the chances of biased marking (Sitthiworachart & Joy, 2004).

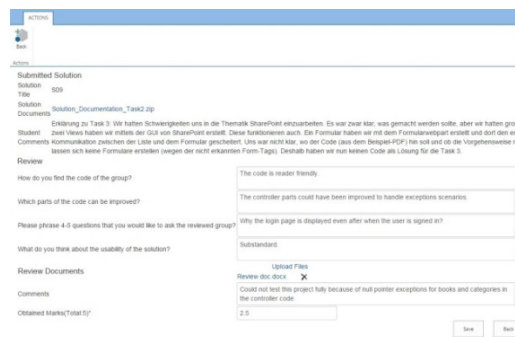


Figure 7: Peer Assessment Interface.

Once the peer review phase starts, the learners can see a list of reviews assigned to them by the teachers. The interface for adding a review can be seen in Figure 7. It contains two sections, the submitted solution on the top and the review section with rubrics at the bottom. The reviewers can see the documents and resources attached to the solution and any comments given by the authors. They can add their comments against the rubric questions in the review section along with an option to upload any files and grade the review as well.

6 CASE STUDY

In October 2014, we conducted a third case study to investigate the usability and effectiveness of the peer assessment module. We used the enhanced edition of L²P-bMOOC to offer a bMOOC on “Education and the Issues of the Age” at Fayoum University, Egypt in cooperation with RWTH Aachen University. Again, the course was offered both formally to students from Fayoum University and informally with open enrollment to anyone who is interested in teaching and education issues. The teaching staff is composed of one professor and one assistant researcher from Fayoum University as well as one assistant researcher from RWTH Aachen University. A total of 133 participants completed this course. 92 formal participants took the course to earn credits from Fayoum University. These participants were required to complete the course and obtain positive grading of assignments. The remaining 41 were informal participants who didn't attend the face-to-face sessions. They have undertaken the learning activities at their own pace without receiving any type of academic credits. The teaching staff provided nine short video lectures and the course participants added another 25 related videos. Participants in the course were encouraged to use video maps to organize their lectures, and collaboratively create and share knowledge through annotations, comments, discussion threads, and bookmarks. Participants used the peer assessment module for the submission of a team project report. After the submission, every team reviewed other's work and provided their feedback based on the rubric questions provided by the teaching staff. These reviews were then taken into consideration by the teaching staff while compiling their own feedback of the team projects. Once the teacher reviews were completed the final corrections were made public to the students who could see both

reviews for their own project namely, the review from peer and the review from the teacher.

7 EVALUATION

We conducted a thorough evaluation of the peer assessment module in L²P-bMOOC in order to answer the main research questions in this work. The aim was to evaluate the usability and effectiveness of the module, including the impact on learning outcome and the quality of feedback. Our endeavor was also to investigate which peer assessment model fits best in a bMOOC context. We employed an evaluation approach based on the ISONORM 9241/110-S as a general usability evaluation as well as a custom questionnaire to measure the effectiveness of peer assessment in L²P-bMOOC.

7.1 Usability Evaluation

The purpose of usability evaluation is to measure learner's satisfaction with the peer assessment module as well as to identify the issues for improvement. The ISONORM 9241/110-S questionnaire was designed based upon the International Standard ISO 9241, Part 110 (Prümper, 1997). We used this questionnaire as a general usability evaluation for the peer assessment module. It consists of 21 questions classified into seven main categories. Participants were asked to respond to each question scaling from (7) a positive exclamation and its mirroring negative counterpart (1). The questionnaire comes with an evaluation framework that computes several aspects of usability to a single score between 21 and 147. A total of 57 out of 133 participants completed the questionnaire. A diversity in learner's age was exhibited by the evaluators, their ages ranging from 18 to 40+ years with almost 65% of the evaluators being between the ages of 18 and 24. Around 70% of the evaluators were Bachelors students, 17% from Masters courses and the remaining 12% pursuing a PhD. All of them had taken one or more online courses. The results obtained from the ISONORM 9241/110-S usability evaluations are summarized in Table 2.

The overall score was 99.1 which translates to “Everything is all right! Currently there is no reason to make changes to the software in regards of usability” (Prümper, 1997). This result reflects a high level of user satisfaction with the usability of peer assessment module in L²P-bMOOC.

Table 2: ISONORM 9241/110-S Evaluation Matrix (N= 57).

Factor	Aspect	M	Sum
Suitability for tasks	Integrity	5.2	15
	Streamlining	5.5	
	Fitting	4.3	
Self-descriptiveness	Information content	4.9	14.5
	Potential support	4.8	
	Automatic support	4.9	
Conformity with user expectations	Layout conformity	4.7	14
	Transparency	4.7	
	Operation conformity	4.6	
Suitability for learning	Learnability	5.4	14.7
	Visibility	4.8	
	Deducibility	4.5	
Controllability	Flexibility	4.9	14.2
	Changeability	4.5	
	Continuity	4.8	
Error tolerance	Comprehensibility	4.7	13.5
	Correct ability	4.6	
	Correction support	4.2	
Suitability for individualization	Extensibility	4.0	13.2
	Personalization	4.3	
	Flexibility	4.9	
ISONORM score		99.1	

7.2 Effectiveness Evaluation

In our study, we focused on peer assessment to support groups or individuals to review, grade and provide in-depth feedback for their peers, based on flexible rubrics. The effectiveness evaluation aims at investigating the impact on learning outcomes and the quality of feedback. This study included the design of a questionnaire adapted from (Brindley & Scofield, 1998; Wolf & Stevens, 2007; Kulkarni et al., 2013). The questionnaire consisted of two main parts. The first part containing 21 items in the two categories mentioned above as illustrated in Table 3. The second part aimed at investigating the most effective peer assessment model in a bMOOC setting, as presented in Table 4. To ensure the relevance of these questions, a pre-test was conducted with 5 learners and 5 learning technologies experts. Their feedback included a refinement of some questions and replacing some others. The revised questionnaire was then given to the “Education and the Issues of the Age” course participants.

Table 3: The Effectiveness Evaluation of Peer Assessment in L²P-bMOOC (N= 57).

No	Peer Assessment		
	Evaluation Items	M	SD
Impact on learning outcome			
1	The peer feedback helped me to see errors in my own work.	4.5	0.50
2	Reviewing others' work helped me to reflect on my own work.	4.4	0.53
3	The received feedback helped me to reflect on my own work.	4.2	0.51
4	The peer assessment helped me to learn how to give constructive feedback to peers.	4.2	0.62
5	The peer feedback helped me to come up with new ideas.	4.4	0.53
6	The comments I received from peer feedback helped to improve the quality of my work.	4.3	0.48
7	The received feedback helped me to get more information about the learning topic.	4.4	0.53
8	Reviewing others' work helped me to expand knowledge about the learning topic.	4.3	0.51
9	The peer assessment increased my ability in organizing ideas and contents in my work.	4.1	0.50
Impact on learning outcome average		4.3	0.52
Quality of feedback			
10	The scoring grade I received from peer feedback was valid.	4.2	0.51
11	The peer feedback I received is accurate and credible.	4.2	0.50
12	I am confident that my peers have enough ability to assess my work.	4.2	0.53
13	I am confident that I have the ability to assess peers' work.	4.3	0.71
14	I put sufficient effort into grading peers' work.	4.5	0.56
15	The peer assessment rubrics and their descriptions were sufficiently clear.	4.3	0.57
16	The peer assessment rubrics supported in providing peers with detailed feedback on their assignment work.	4.4	0.62
17	The peer assessment rubrics assisted me in focusing on particular details in the peers work.	4.4	0.53
18	The description of the rubrics helped me understand what teachers expected in the evaluation report.	4.4	0.54
19	The peer assessment rubrics made the review task clearer.	4.4	0.56
20	The peer assessment rubrics made the review process more transparent.	4.3	0.54
21	The peer assessment rubrics were necessary to complete my review task.	4.4	0.53
Quality of feedback average		4.3	0.55
1. Strongly disagree ... 5. Strongly agree			

7.2.1 Impact on Learning Outcome

Respondents were asked to indicate whether the peer assessment has affected their learning outcome. As can be seen from Table 3, the overall response to the evaluation items 1-9 was very positive at 4.3 with acceptable standard deviation at 0.52. This indicates that peer assessment is a powerful evaluation method to detect and correct errors, reflect, and criticize which are key elements in double-loop learning. The concept of double-loop learning was introduced by Argyris and Schön (1978) within an organizational learning context. According to the authors, learning is the process of detecting and correcting errors. Error correction happens through a continuous process of inquiry, reflection, and (self-) criticism, which enables learners to test, challenge, and eventually update their knowledge, and in so doing improving their learning outcome (Chatti et al., 2012).

Peer assessment further fosters continuous knowledge creation, which is a prerequisite for effective learning (Nonaka and Takeuchi, 1995). This can be attributed to the fact that in the peer assessment process, learners can learn from either negative or positive aspects of peer's work and make use of them to get in-depth understanding of the learning topic and improve their knowledge, which leads to an enhancement of their learning performance.

7.2.2 Quality of Feedback

Key challenges in peer assessment include the diversity of reviewers' background and prior experience (Yousef et al., 2015b), the lack of accuracy and credibility of peer feedback (Suen, 2014) as well as the lack of transparency of the review process. Moreover, MOOC participants do not trust the validity and reliability of peer assessment results due to the absence of a clear evaluation authority (e.g. teacher) and the low perceived expertise of students (McGarr & Clifford, 2013).

Rubrics provide a possible solution to overcome these issues by offering clear guidelines when assessing peer's work. Items 10 to 21 in Table 3 are concerned with the quality of the rubric-based peer feedback approach employed in L²P-bMOOC. In general, the respondents agreed that harnessing rubrics had a positive impact on the quality of the peer assessment task, in terms of the accuracy and credibility of peer feedback (item 11), transparency of the review process (item 20), as well as validity

and reliability of peer assessment results (item 10 and 12). Moreover, the study revealed that participants are confident in their ability to assess peers' work. They confirmed that following clear rubrics helped them understand the evaluation criteria and supported them in providing peers with detailed feedback.

7.3 Peer Assessment Models

An important goal in our study was also to investigate which peer assessment model fits best in a bMOOC context, as presented in Table 4.

Table 4: Peer Assessment Models in bMOOCs.

Peer Assessment Models	Mean	SD
Time		
Early feedback	4.6	0.50
Delayed feedback	1.7	0.44
Anonymity		
Double blind review	4.6	0.48
Single blind review	2.3	0.61
Open review	1.7	0.88
Delivery		
Indirect feedback (i.e., written)	4.6	0.72
Direct feedback (i.e., face-to-face)	2.2	0.68
Peer Grading		
Review with grading	3.1	0.86
Review with partly grading	4.4	0.79
Review without grading	1.9	0.41
Peer Grading Weight		
Contributing to the final official grade	3.8	0.93
Not contributing to the final official grade	2.9	1.20
Channel		
Single channel feedback (1:1)	2	0.52
Multiple channel feedback (m:n)	4.8	0.34
Review Loop		
Single loop	2	0.73
Multiple loop	4.8	0.34
Teacher Role		
Substitution	2.1	0.57
Supplementary	4.3	0.58
Monitoring	2.9	0.87
1. Strongly disagree ... 5. Strongly agree		

We can draw certain conclusions about the most effective peer assessment practices in bMOOCs as follows:

Time: Optimal feedback should be provided early in the assessment process in order to give learners the opportunity to react and improve their work.

Anonymity: An important aspect of peer assessment is to ensure the anonymity of the feedback. This way, reviewers can provide critical feedback and

grading without considering interpersonal factors e.g. friendship bias or personal dislikes.

Delivery: Indirect feedback ensures more effective assessment results as learners feel more comfortable to give honest feedback without any influence from peers.

Peer Grading: Peer grading should only be a part of the final grade in order to ensure the validity of the assessment results.

Channel: Assessment results can be more accurate and credible when learners receive feedback from multiple reviewers rather than from a single one. This way, learners have the chance to receive a multifaceted feedback on their work.

Review Loop: Having multiple feedback iteration achieve a better learning outcome as learners can reflect on the assignment work multiple times.

Teacher role: The teachers should still take an active role in the peer assessment process, by defining evaluation rubrics, providing sample solutions, and checking the peer review results. They can also help in developing review skills.

8 CONCLUSIONS

MOOCs have attracted a huge number of participants around the globe to attend free online courses in variety of domains. However, one of the greatest challenges facing MOOCs is how to assess the learners' performance in larger class sizes beyond traditional automated assessment methods. Peer assessment has been proposed as an effective assessment method in MOOCs to address this challenge. The issue is, however, how to ensure the quality of the peer assessment in terms of validity, and reliability. Moreover, assessment in blended MOOCs (bMOOCs) introduces unique challenges regarding the best peer assessment model in a bMOOC context.

This paper presents the details of a study conducted to investigate peer assessment in bMOOCs. The study results show that flexible rubrics have the potential to make the feedback process more accurate, credible, transparent, valid, and reliable, thus ensuring the quality of the peer assessment task. Furthermore, early feedback, anonymity, indirect feedback, peer grading as only a part of the final grade, multiple channel feedback, multiple feedback loops, as well as a supplementary teacher role are the most effective assessment methods in bMOOCs.

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