Guidelines for Preparing for, Designing, and Implementing Peer Assessment in Online Courses

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Abstract
Peer assessment (PA) is widely implemented in higher education, and it can play an important role in online learning by connecting students to their peers and enabling feedback from multiple sources. However, high-quality feedback is not guaranteed. And students tend not to use peer feedback. Preparing for, designing, and implementing PA can be challenging for instructors, especially those who are relatively new to online teaching. This paper proposes guidelines for preparing for, designing, and implementing PA based on a review of empirical studies. The paper first reviews the benefits of PA, the important role that PA can play in online courses, and the need for effective preparation, design, and implementation of PA activities in online courses. Afterwards, based on a review of empirical studies that aim to improve the effectiveness of technology-facilitated PA interventions, the paper proposes guidelines for PA activities.
Keywords: peer assessment, peer assessment guidelines, online courses, higher education

INTRODUCTION

Peer assessment (PA) activities are widely used in higher education. PA can include grading and/or providing comments. Students who assess peers' work can be referred to as assessors, and those whose work is assessed are assessees. In most cases, students play both roles. PA has been implemented in various types of courses in higher education, such as dance education (Hsia et al., 2016), introductory physics (Y. H. Cho & Cho, 2011), instructional design (Fang et al., 2021), nursing education (H.-C. Lin et al., 2021), clinical epidemiology (Filius et al., 2018), and computer engineering programming (a calculus and numerical methods course) (Rico-Juan et al., 2021). Interest in PA is also indicated by the number of meta-analyses in recent years (e.g., Chang et al., 2021; H. Li et al., 2020; Panadero & Alqassab, 2019; Tenório et al., 2016; Zhan et al., 2022; Zheng et al., 2020).

The potential benefits of PA reside in two aspects: providing and receiving feedback (Van der Pol et al., 2008). However, high-quality peer feedback is not guaranteed, and students tend not to use feedback, especially in online courses. These issues prevent students from reaping the benefits of PA. In an era when online education is ubiquitous, designing and implementing PA activities can be challenging for instructors, especially those who are relatively new to online teaching. This paper proposes guidelines to help instructors prepare for, design, and implement PA. The guidelines are grounded in a review of research articles that aim to improve the effectiveness of PA.

LITERATURE REVIEW

BENEFITS OF PA

Students can benefit from PA in several ways. First of all, assessors can learn during PA, and thus improve their own work. Specifically, they can develop a better understanding of the project requirements, scoring criteria, and the topic (Y. H. Cho & Cho, 2011; Hsia et al., 2016; Noroozi et al., 2016); generate more ideas (Hsia et al., 2016); learn from their peers' work (Hsia et al., 2016), and critically reflect on their own work (Ertmer et al., 2007; Fang et al., 2021). Ertmer et al. (2007) argued that "perhaps the greatest potential benefit of the peer feedback process lies in the constructive aspect of forming and justifying peer feedback." (p. 428). Cho & Cho (2011) found that providing comments on weaknesses at the micro level (i.e., the content of one paragraph) and comments on strengths at the macro level (i.e., the content across several paragraphs) of peers' laboratory reports positively affected the quality of assessors' own revised reports. Similarly, Li et al. (2010) found a positive correlation between the quality of the feedback students constructed and the scores of their final projects. Van der Pol et al. (2008) concluded that as long as students expend effort to review their peers' work and compose feedback, learning benefits can be expected.

As assessees whose work is evaluated by peers, students can receive feedback that can contribute to the improvement of their performance (Hsia et al., 2016). The benefits of receiving peer feedback, to a large extent,

hinge upon the usefulness of the feedback and, more importantly, on how students use the feedback. And the use of feedback significantly affects the quality of students' final projects (L. Li et al., 2012).

However, students are not experts in the content area. Some feedback may be incorrect or misleading. Sometimes comments from multiple assessors are contradictory, which can confuse assessees (Mostert & Snowball, 2013). Also, students do not consider their peers a "knowledge authority" (S. Gielen et al., 2010, p. 305) and are skeptical of their peers' ability to provide feedback. This skepticism can have both positive and negative impacts on assessees. Specifically, the skepticism may result in reluctance to take peer assessors' advice or resistance to peer feedback. For example, Kim (2005) found no correlation between peer feedback scores and students' performance and attitudes toward peer feedback. The author speculated that assessees did not trust their peers' ability to provide feedback, which prevented them from internalizing the feedback. However, on the other hand, a skeptical attitude may lead assessees to develop their own ideas for improvement. In Gielen et al's (2010) study, students initiated more self-correction when they received peer feedback than when receiving feedback from the instructor. Video recordings of the interactions between students during PA along with interview data showed that students "doubted" peer feedback, which led to the development of their own ideas to improve their essays.

PA AND ONLINE LEARNING

The COVID-19 pandemic made online teaching and learning compulsory for instructors and students in higher education. Therefore, "it is no longer a question of whether online education can deliver the promise of a quality higher education and rather one of how can universities immediately and effectively embrace mass adoption of online learning" (Liguori & Winkler, 2020, p. 347). PA, a form of collaborative learning, could play a more important role in online classes than in face-to-face classes. First, through PA, students receive feedback from peers, which has the potential to improve students' satisfaction with online courses because a lack of feedback leads to attrition from online courses (Ertmer et al., 2007). In online courses, feedback "is one of the few processes that connects individual learners to instructor and peers" (Jensen et al., 2021, p. 1). PA can increase the interactions between students (Van der Pol et al., 2008) and build the connections between students and their peers. Martin et al. (2019) investigated exemplary online teaching practices by interviewing eight instructors who had received teaching awards from three large online teaching and learning organizations (The Online Learning Consortium, Association for Educational Communications and Technology, and United States Distance Learning Association). All interviewees reported that a learning community is key to successful online learning, and one of the strategies to create a learning community is to use PA activities, the other two being online discussion and group projects.

NEED FOR EFFECTIVE PREPARATION, DESIGN, AND IMPLEMENTATION OF PA ACTIVITIES IN ONLINE COURSES

Acting upon feedback, or "a successful uptake" of feedback, is critical (Van der Pol et al., 2008, p. 1805). Students' willingness to act upon feedback largely hinges upon the quality of the feedback, which is not guaranteed. First, many college students do not have PA skills, including understanding the evaluation criteria, judging peers' performances, and composing constructive feedback. Second, not all students put a lot of effort into providing quality feedback. In a study by Mostert & Snowball (2013), economics students in a large-enrollment class assessed their peers' essays. About half (47%) of the students reported that the PA activity was not useful, among which 29% indicated that their peers' engagement in PA was superficial, which was evidenced by the following student's comment: "People didn't even bother reading the essays they just commented on what they expected to be in there. How do you explain saying I have a good diagram when there is no diagram?" (p. 681) In the same study, students also reported that they expended efforts to create constructive feedback, but the feedback they received did not reflect their own efforts (Mostert & Snowball, 2013). When assessees do not receive high-quality feedback, they do not consider PA worthwhile, and they may lose the motivation to invest time and energy to compose constructive comments. This may be particularly true in a class where multiple cycles of PA are conducted. Third, the psychological and social barriers to PA (i.e., considering critiques as personal attacks) may lead to friendship marking or surface-level feedback (Noroozi et al., 2016; van Gennip et al., 2010).

Even when high-quality peer feedback is provided, students will not benefit from it if they do not use the feedback. For example, Kim (2005) found no correlation between peer feedback scores and students' performance. The author speculated that assesees did not trust their peers' ability to provide feedback, which prevented them from internalizing the feedback. This lack of internalization made it impossible for the assessees to reap the benefits of receiving peer feedback.

Online students tend not to engage in feedback provided by instructors. Mensink and King (2020) used data mining to analyze feedback files stored in a learning management system. The study revealed that 38% of the files were never opened by students. This percentage was even higher (42%) when students were allowed to see their grades without having to downloading the files. The account from a student in Winstone et al.'s study (2021) seems to

provide a vivid description of how online students used feedback: "Check the grade, log out." One of the main reasons for students' lack of engagement in feedback in these two studies is how feedback was delivered: students could access their grades without having to open the feedback files. In Mensink and King's study (2020), when grades were revealed in the feedback files instead of being separately posted on the learning management systems, the percentage of unopened feedback files decreased substantially to 17%. If students do not engage in online feedback provided by instructors, it is very unlikely that they will be more engaged in peer feedback.

METHODS

LITERATURE SEARCH

In this paper, guidelines for PA are proposed based on a review of the empirical studies published since 2010 because, in the early 2010s, conceptualization of feedback shifted from something delivered to students to a process in which students played an active role. For example, Shute (2008) conceptualized feedback as "information communicated to the learner" in her review of feedback studies (p. 154), and Hattie and Timperley (2007) defined feedback as "information provided by an agent" (p. 81). Later, feedback was viewed as a process that facilitates student learning and that requires students to play an active role (Boud & Molloy, 2013). Hattie and Gan (2011) emphasized that "feedback needs to move from a predominantly transmissive and verification process to a dialogic and elaborative process in a social context" (p. 257).

Articles were located in specific technology-facilitated learning journals, as suggested by Hwang & Tsai (2011) and Fu et al (2019). These journals included *British Journal of Educational Technology*, *Computers and Education*, *Educational Technology & Society*, *Educational Technology Research and Development*, *Interactive Learning Environments*, *Journal of Computer Assisted Learning*, and *Innovations in Education and Teaching International*. Given the nature of this topic, literature was also searched in other educational journals, including *Journal of Educational Computing Research*, *The Internet and Higher Education*, *Computers in Human Behavior*, *Assessment and Evaluation in Higher Education*, *Learning and Instruction*, and *Instructional Science*. Search terms included *peer assessment*, *peer evaluation*, *peer review*, *peer feedback*, and *peer comment*.

The criteria for inclusion were the following: (a) the article was published after 2010, (b) the study was empirical and conducted in higher education, (c) the PA activity was performed in online classes or was facilitated by technology, and (d) the purpose of the intervention was to improve the effectiveness of PA. A total of 30 articles were reviewed. See the list of articles in Table 1.

GUIDELINES

Three sets of guidelines are proposed for preparing for, designing, and implementing PA activities. I will explain each guideline and describe the empirical studies that it is built on. Table 1 lists the guidelines, the empirical studies supporting each guideline, and the major findings of those studies.

GUIDELINE 1 (PREPARATION): PROVIDE PA TRAINING TO PREPARE FOR PA

PA training is necessary to help students develop a positive attitude toward PA and enhance their willingness to use peer feedback as students do not consider themselves (Orsmond & Merry, 1996) or their peers (van Gennip et al., 2010) qualified to conduct PA. Furthermore, successful PA interventions hinge upon students' ability to conduct PA (Liu & Li, 2014). Van Zundert et al's (2010) review of the empirical studies published between 1990 and 2007 in educational research journals showed that PA training positively affected students' attitudes towards PA and improved the reliability and validity of PA. Empirical studies also reveal that students found that PA training was valuable (Filius et al., 2018), that PA training increased the accuracy of student ratings (Liu & Li, 2014) and the quality of students' work (Liu et al., 2018).

To help students understand evaluation criteria, identify the strengths and weaknesses of peers' work, and provide feedback, online instructors can use training strategies that include (a)

Table 1: *Guidelines, the Empirical Studies Each Guideline is Grounded upon, and the Empirical Study Findings*

Guideline	Rationale	
	List of empirical studies supporting the guideline	Major findings of the studies
Guideline (preparation): 1.	Filius et al., 2018; Liu &	In Filius et al.'s (2018) study, the PA intervention for an online course consisted of three steps: a) PA training; b) feedback and

Provide PA training to prepare for PA	Li, 2014; Liu et al., 2018; Van Steendam et al., 2010	rating, and c) optional feedback discussion. For the training, students were provided with text and a video that explained how to provide peer feedback that could enhance assessees' deep learning, along with good examples of peer feedback that could facilitate deep learning as well as bad examples. Students reported during the interview that the PA training was valuable. In another study (Liu & Li, 2014), the PA training consisted of helping students understand the rubric and having students grade example projects. Specifically, students watched a video highlighting the major evaluation criteria in the rubric and engaged in the whole-class discussion on key terms in the rubric. Students then assessed two example WebQuest projects created by previous students and compared their assessments with the instructor's, and the whole class had a discussion on the evaluation of the two projects. The study found that the training decreased the discrepancy between the student and instructor ratings, and the smaller the discrepancy, the higher the peer feedback quality. In Liu et al. (2018), the PA training took the form of business students' synchronous group discussions on the grading of a poor counter-offer letter and an excellent one in online chat rooms. The training improved the quality of students' counter-offer letters. In Van Steendam et al. (2010), students received one of two types of instruction: observation and practice. In the observation condition, students individually watched a video of two experts interactively modeling how to use the revision strategy provided to revise a letter. In the practice condition, students worked in pairs to practice revising a letter by using the revision strategy, after which they were provided a model answer. After the instruction, students were assigned to one of the two emulation conditions, individual emulation and dyad emulation, to practice composing feedback by using the criteria provided by the instructor. The study found that observational learning and practice were equally effective if the following emulation was individual, and that observational learning was more effective than practice if the following emulation was collaborative.
Guideline 2.1. (PA design): Consider the impact of group formation on PA	Author, 2018; Cho & MacArthur 2010; Papadopoulos et al., 2012	Author (2018) provided the experimental group with autonomy support by providing a rationale for PA, allowing students to choose two of the three evaluation criteria to focus on, acknowledging negative feelings, and using non-controlling language. The control and experimental groups did not differ in their engagement in PA and academic performance, but the experimental group reported a higher level of autonomy and spent more time on each evaluation criterion than the control group. Cho & MacArthur (2010) found that feedback provided by multiple peers led to more complex repair revisions (i.e., deleting points or revising existing points at the micro level) and revisions that added elaborations than feedback from a single expert or peer. Complex repair revisions predicted writing quality. In Papadopoulos et al. (2012), students in the free-selection group could access all peers' answers to open-ended scenarios. They could read as many answers as they wanted to and then selected three to review. The study found that, compared with the students who were randomly paired for review, students in the free-selection group acquired more domain conceptual knowledge and showed higher PA skills.

Guideline 2.2. (PA design): Consider the pros and cons of anonymity	Güler, 2017; Howard et al., 2010; Li, 2017; Lin, 2018; van den Bos & Tan, 2019	In Güler (2017), the survey results showed that anonymity did not affect students' perceived fairness of PA. However, student interviews suggested that most of the students who were concerned about the fairness of PA were in the non-anonymous group. The peer ratings made by the anonymous group were more correlated with the instructor ratings. Howard et al. (2010) revealed that, students in the non-identified group were about five times more likely to create critical feedback and four times more likely to provide justifications for the improvements they suggested than those who were known to their peers. In Li (2017), students were placed in one of the three groups: the Identify Group, in which students' identities were known to their peers; the Anonymity Group in which students' identities were not revealed, and the Training Group in which students received training on the purpose and benefits of PA and the strategy used in the study to address their concerns related to being identifiable. The study found that the Identity Group's final project scores were the lowest. The Training Group had a higher perception of the usefulness of PA and a lower perception of pressure than either the Identity Group or the Anonymity Group. Lin (2018) found that students in the anonymous group reported more learning from PA than their counterparts. The former had a more positive attitude toward the PA system and a lower level of perceived fairness of peer comments than the latter. In van den Bos & Tan (2019), the anonymous group provided significantly more higher-order feedback (feedback on ideas, organization, argumentation, etc.), generated less feedback on directive lower-order concerns, processed more directive higher-order feedback, and obtained higher scores on their revised essays, compared with the non-anonymous group.
Guideline 2.3. (PA design): Combine peer grading and peer comments to maximize student learning, and encourage assessors to address both strengths and weaknesses and provide sufficient explanations	Cho & Cho, 2011; Fang et al., 2021; Hsia et al, 2016; Huisman et al., 2018; Noroozi et al., 2016	Cho & Cho (2011) found that providing strength comments at the macro level (i.e., the content of writing across several paragraphs) and weakness comments at the micro level (i.e., the content of writing in one paragraph) on peers' laboratory reports positively influenced the quality of the assessors' own revised reports. Fang et al (2021) found that the experimental group, in which pre-service teachers collaboratively rated and provided comments on another group's video, created videos of higher quality and showed higher self-efficacy in successfully completing the course and critical thinking skills than the control group who only rated their peers' videos. Huisman et al. (2018) found that feedback justifications were positively correlated with perceived adequacy of peer feedback and willingness to use peer feedback. Hsia et al (2016) put students in one of the three groups when they reviewed peers' group dance performance videos: (a) peer grading, (b) peer feedback, and (c) mixed mode (grading + feedback). They found that the mixed group showed the best performance by providing more detailed feedback, giving scores more correlated with the instructor's scores, and participating in the PA activity more frequently.

		Noroozi et al. (2016) examined the impact of a peer feedback script on the quality of students' argumentative essays and how the PA process affected the quality of students' essays. The peer feedback script consisted of questions to guide the provision of feedback on argumentative essays and what should be incorporated in essays. The study found that the script improved the quality of students' argumentative essays and that students who provided and received more constructive and justified feedback scored higher on the argumentative essays.
Guideline 2.4. (PA design): Use strategies to actively engage assessees in PA	Filius et al., 2018; M. Gielen & De Wever, 2015; Kim & Ryu, 2013; Lin et al., 2021, Yang, 2011	In Filius et al. (2018), assessees had dialogues with assessors. Additionally, assesses rated the feedback they received. Assessees reported during interviews that having to rate peer feedback forced them to read the feedback in detail and look critically at their own work. M. Gielen & De Wever (2015c) examined the impacts of (a) a peer feedback request form that asked assessees to list the feedback they needed on the abstract they wrote, (b) a content checklist form that asked assessors to check the essential components of an abstract, and (c) a peer feedback template on students' peer feedback quality and final abstracts. The peer feedback template included four sections: (a) a list of the criteria that could be used to assess the abstracts peers wrote, (b) a section to leave peer feedback, (c) a section to make suggestions for improvement, and (d) a section for the writer of the abstract to evaluate the quality of the peer feedback given to them. The study found that peer feedback requests significantly improved the quality of peer feedback over time. The peer feedback template positively affected the quality of students' final products. Kim & Ryu (2013) created a web-based PA system that could provide students with meta-cognitive scaffolding and that allowed assessors and assessees to discuss the peer feedback. The study found that the system promoted students' metacognitive awareness, academic performance, and motivation in conducting PA. In Lin et al. (2021), the experimental group individually rated three peers' physical examination skill practices and gave feedback to their peers. Assessees evaluated whether assessors' ratings were reasonable and commented on the peer feedback they received. The intervention improved students' performance on the post-learning achievement test, as well as their physical examination skill, critical thinking tendency, and reflective skill. In a study by Yang (2011), assessees evaluated assessors' comments on their essays and responded to the comments (e.g., "Thank you for the suggestion. I'll revise it.") (p. 691).
Guideline 2.5 (PA design): Encourage interactions between students	Filius et al., 2018; Yu, 2011; Zheng et al., 2018	In Filius et al.'s (2018) study, after online students went through PA training and completed the PA activity, assessors and assessees discussed peer feedback in a discussion forum, but the discussion was optional. Students reported that they made little use of feedback discussion. Interview results suggested two reasons: the discussion was optional and having to navigate to another virtual location to discuss feedback made students less motivated to engage in the discussion. In Yu (2011), pre-service teachers conducted PA in one of three modes: one-way, two-way, and multi-way. In the two-way mode, assessors and assessees could have conversations on the peer ratings and feedback. In the multi-way mode, online conversations took place between assessors and assessees as well as among multiple

		assessors. The survey results showed that pre-service teachers liked the multi-way mode best, and they liked the two-way mode better than the one-way mode. Zheng et al. (2018) found that the experimental group who had online synchronous discussions on peer feedback outperformed the control group in writing performance, peer feedback quality, metacognitive awareness, and self-efficacy in PA.
Guideline 3. (implementation): Provide structure and use technologies to help ensure a smooth implementation of PA	Çiftçi & Koçoğlu, 2012; Güler, 2017; M. Gielen & De Wever, 2015a; M. Gielen & De Wever, 2015b; M. Gielen & De Wever, 2015c; Mostert & Snowball, 2013; Noroozi et al., 2016; Novakovich, 2016; Novakovich & Long, 2013; Papadopoulos et al., 2012; Samaie et al., 2018; van Den Bos & Tan, 2019; Yang 2011	Çiftçi & Koçoğlu (2012) found that the group that had blog-mediated PA scored higher on their revised drafts than did the group that conducted face-to-face PA. Güler (2017) found that the personal messaging function of WhatsApp could make PA anonymous. M. Gielen & De Wever (2015a) used peer feedback templates with varying degrees of structure (no structure, basic structure, and elaborated structure). The non-structure group was provided with a list of assessment criteria. The basic-structure group was provided with assessment criteria and two guiding questions ("What do you like about your peers' work and "What would you change in your peers' work?"). The elaborated-structure group received a template created based on the principles of feed up (i.e., state the goal), feedback (i.e., assess how peers did), and feed forward (i.e., offer suggestions for improvement). This group needed to formulate the feed up, feedback, and feed forward for each of the ten criteria. One of the major study findings was that the basic structure led to more feedback elaborations, but the elaborated structure did not. M. Gielen & De Wever (2015b) used the same template with varying degrees of structure (no structure, basic structure, and elaborated structure) as in M. Gielen & De Wever (2015a). M. Gielen & De Wever (2015b) examined the impacts of the templates on feedback and product quality. They found that the elaborate structure led to feedback of higher quality than no structure did. The elaborate and basic structures led to higher product scores than no structure did. M. Gielen & De Wever (2015c) examined the impacts of (a) a peer feedback request form that asked assessees to list the feedback they needed on the abstract they wrote, (b) a content checklist form that asked assessors to check the essential components of an abstract, and (c) a peer feedback template on students' peer feedback quality and final abstracts. The peer feedback template included four sections: (a) a list of the criteria that could be used to assess the abstracts peers wrote, (b) a section to leave peer feedback, (c) a section to make suggestions for improvement, and (d) a section for the writer to evaluate the quality of the feedback given to them. The study found that peer feedback requests significantly improved the quality of peer feedback over time. The peer feedback template positively affected the quality of students' final products. Mostert & Snowball (2013) used Moodle for anonymous PA in a large-enrollment economics class. Noroozi et al. (2016) examined the impact of a peer feedback script on the quality of students' argumentative essays and how the PA process affected the quality of students' essays. The peer feedback script consisted of questions to guide the provision of feedback on two peers' argumentative essays and a list of elements that should be included in high-quality argumentative essays. The study found that

	the peer feedback script improved the quality of students' argumentative essays and that students who provided and received more constructive and justified feedback scored higher on the argumentative essays. Novakovich (2016) and Novakovich & Long (2013) used blogs for PA. Papadopoulos et al. (2012) provided students with review guidelines that consisted of three questions to direct students' attention to the content, argumentation, and expression of their peers' answers to open-ended scenarios. Samaie et al., 2018 used WhatsApp for self-assessment and PA. The PA system Yang (2011) created provided definitions and examples of local and global errors for students who assessed their peers' essays. van Den Bos & Tan (2019) used the free online program called Peergrade for PA.

providing videos, presentations, or text-based materials that explain the evaluation rubric and how to conduct PA, (b) providing good and bad evaluation examples, and (c) asking students to discuss the gradings of sample work or practice assessing sample work. For example, in Filius et al.'s (2018) study, researchers aimed to use PA to improve students' deep learning. For the training, students were provided with text and a video that explained how to provide peer feedback that could enhance assessees' deep learning. They were also provided with good examples of peer feedback that could contribute to deep learning as well as bad examples. Aiming to provide interactive training, Liu et al. (2018) had students discuss the grading of a poorly written and a well-written writing sample in small groups in online chat rooms. In another study (Liu & Li, 2014), the PA training consisted of helping students understand a rubric and having students grade example projects. Specifically, students watched a video highlighting the major evaluation criteria in the rubric and engaged in a whole-class discussion of key terms in the rubric. They then assessed two example WebQuest projects created by previous students and compared their assessments with the instructor's. Similarly, Van Steendam et al. (2010) asked students to individually or collaboratively practice composing feedback on peers' writings, following the revision strategy instruction.

GUIDELINE 2.1 (PA DESIGN): CONSIDER THE IMPACT OF GROUP FORMATION ON PA

Feedback from multiple peers seems to be more beneficial than feedback from a single peer, so assigning more than two students to a group is recommended. Cho & MacAuthur (2010) found that feedback from multiple peers led to more complex repair revisions (i.e., deleting points or revising existing points at the micro level) and more revisions that added elaborations than feedback from a single expert or peer. In addition, even when instructor feedback is provided, having students provide and receive peer feedback can contribute to student learning, as suggested by Tai et al. (2015), who found that the experimental group that received instructor and peer feedback outperformed the control group that only received instructor feedback in the final drafts of their writing. If technologies allow, instructors can ask students to freely select which work to review, or which evaluation criteria to focus on. In Papadopoulos et al. (2012), students in the free-selection group could access all peers' answers to the open-ended scenarios and freely select three peers' work to review. The study found that, compared with the students who were randomly paired for review, the free-selection group acquired more domain conceptual knowledge and showed higher PA skills. In Author (2018), students who were allowed to choose two of the three evaluation criteria to focus on when providing feedback on their peers' essays spent more time on each evaluation criterion than those in the control group did.

GUIDELINE 2.2 (PA DESIGN): CONSIDER THE PROS AND CONS OF ANONYMITY

PA is a social activity that involves at least two students. It can be affected by "friendship bonds, enmity or other power processes, group popularity levels of individuals, perception of criticism as socially uncomfortable or even socially rejecting and inviting reciprocation, or collusion leading to lack of differentiation" (Topping, 2003, p. 67). As a result, students do not feel comfortable criticizing their peers' and, in particular, their friends' work (Dochy et al., 1999; Sluijsmans et al., 2002). This is evidenced by students in Samaie et al's study (2018) where students used WhatsApp to assess their peers' and their own audio recordings. One student commented, ". . . if I give a bad mark to some classmates, it will make them sad. Mobile peer-assessment is not reliable due to friendship among students." (p. 118)

Anonymity can alleviate peer pressure (Vanderhoven et al., 2015), decrease the uneasiness stemming from the reluctance to provide negative comments (van den Bos & Tan, 2019), and lead to honest comments (Guardado & Shi, 2007). For example, Howard et al (2010) found that students in an anonymous group were five times more likely to provide critical feedback than students in an identifiable group.

Anonymity can also have a positive impact on assessees' use of peer feedback. Students tend to be reluctant to use the feedback provided by less-capable peers even when the feedback is correct (R. Lu & Bol, 2007; van den Bos & Tan, 2019). Without knowing the peer's status and past academic performance, students may be more likely to engage in deep and critical thinking before deciding to accept or reject the feedback (van den Bos & Tan, 2019). The study by van den Bos & Tan (2019) revealed that the anonymous group processed more directive higher-order feedback (feedback on ideas, organization, argumentation, etc.).

Because it can lead to negative and honest feedback and assessees' deep thinking, anonymity has the potential to boost student learning, which is evidenced by empirical studies. Li (2017) and van den Bos & Tan (2019) found that the anonymous group scored higher on their final products than the group in which identities were known. In addition, anonymous assessors perceived higher learning from PA, as revealed by G.-Y Lin (2018).

In terms of the impacts of anonymity on the perceived fairness of PA and assessment accuracy, research shows mixed results. Güler (2017) found that anonymity did not affect students' perceived fairness of PA. Student

interviews suggested that most of the students who were concerned about the fairness of PA were in the non-anonymous group. However, anonymity resulted in assessors' lower perceptions of fairness of peer comments in G.-Y. Lin (2018). Anonymity may also compromise the accuracy of peer rating. A meta-analysis of empirical studies (H. Li et al., 2016) found that non-anonymous PA led to a higher correlation between peer and teacher ratings than anonymous PA. Anonymous assessors may provide harsher criticism and anonymity may lead to a lack of accountability (H. Li et al., 2016). However, Güler (2017) found a higher correlation between peer and instructor ratings in the anonymous group than in the non-anonymous group.

Another negative impact of anonymity is that it may lead to superficial engagement, as suggested by (Mostert & Snowball, 2013). Being aware that the instructor and assessees do not know who provided the feedback, assessors may not invest effort in providing quality feedback. When PA is anonymous, one strategy to ensure feedback quality is to ask students to evaluate peer feedback, as suggested by (Mostert & Snowball, 2013).

When it is not viable to make PA anonymous, instructors can employ strategies to mitigate the negative impact of non-anonymity on student learning. One strategy is to sufficiently explain why PA activities are used. Li (2017) educated students on the purpose and benefits of PA and informed them of the protocol the study used to address their concerns related to being identifiable. Students who received the training scored higher on their final projects than those who did not.

GUIDELINE 2.3 (PA DESIGN): COMBINE PEER GRADING AND PEER COMMENTS TO MAXIMIZE STUDENT LEARNING, AND ENCOURAGE ASSESSORS TO ADDRESS BOTH STRENGTHS AND WEAKNESSES AND PROVIDE SUFFICIENT EXPLANATIONS.

Requiring students to grade their peers' work and provide comments seems to maximize learning benefits. Hsia et al. (2016) found that the mixed-mode group (the group that graded their peers' work and provided feedback) provided more detailed feedback than the group that only crafted peer feedback. The scores provided by the mixed-mode group were more correlated with those awarded by the instructor than those provided by the peer grading group (the group that only graded their peers 'dance performance without composing peer feedback). Students who received both peer feedback and peer grading achieved the best dance performance, while those who only received peer feedback performed the worst. Similarly, Fang et al. (2021) found that the experimental group in which pre-service teachers collaboratively rated and provided comments on another group's video projects created higher-quality products and showed higher self-efficacy in successfully completing the course and in critical thinking tendencies than the control group who only rated their peers' work.

In terms of the content of peer feedback, comments about both strengths and weaknesses should be provided. Cho & Cho (2011) found that providing weakness comments at the micro level (i.e., the content within one paragraph) and strength comments at the macro level (i.e., the content across several paragraphs) of peers' laboratory reports positively affected the quality of assessors' own revised reports. This is probably because when assessors were reviewing their peers' reports, they developed a better understanding of how readers would interpret their reports and learned from their peers the effective strategies for writing a report. However, the comments on strengths of surface features negatively affected the quality of assessees' final drafts. The authors speculated that the comments on strengths might have led to assessees' over-confidence in their writing quality.

In addition, assessors need to provide sufficient explanations in their feedback. Explanatory feedback can lead to assessees' positive perceptions of the feedback, as shown by Huisman et al. (2018). It can also make it easier for assessees to act upon the feedback (J. Lu & Law, 2012). In addition, the explanations can improve assessors' and assessees' academic performance. In a study by Noroozi et al (2016), feedback quality was assessed in terms of whether feedback on the elements of high-quality argumentative essays and feedback justifications were provided. The study found that students who provided and received more constructive and justified feedback scored higher on their argumentative essays.

GUIDELINE 2.4 (PA DESIGN): USE STRATEGIES TO ACTIVELY ENGAGE ASSESSEES IN PA

In order for PA to be successful, assessees should be actively engaged in PA. The literature discusses several strategies to promote assessees' mindful reception of peer feedback. First, instructors can ask assessees to specify the feedback they need, which can direct assessors to provide feedback that addresses their peers' concerns and thus improve the quality of peer feedback (M. Gielen & De Wever, 2015c). In a study by M. Gielen & De Wever (2015c), a peer feedback request significantly enhanced the quality of peer feedback over time. The second strategy is to ask assessees to explain how they used feedback (Yang, 2011). Third, instructors can ask assessees to evaluate assessors' ratings and peer feedback. In a flipped nursing education class (H.-C. Lin et al., 2021), assessees evaluated whether assessors' ratings were reasonable and responded to peer feedback, the purpose of which was to provide students with an opportunity to make reflections. In a study by Yang (2011), assessees evaluated

assessors' comments on their essays and responded to the comments (e.g., "Thank you for the suggestion. I'll revise it.") (p. 691). In an online class (Filius et al., 2018), in addition to having a dialogue with assessors about the peer grading and feedback, assessees rated the feedback they received. Assessees reported during the interview that having to rate peer feedback forced them to read the feedback in detail and look critically at their own work.

GUIDELINE 2.5 (PA DESIGN): ENCOURAGE INTERACTIONS BETWEEN STUDENTS

Vagueness has been revealed as one of the reasons why assessees do not use peer feedback (Min, 2005). In online classes where students rarely communicate with their peers in person, synchronous or asynchronous discussions can lead to better understanding of feedback and peer ratings and improve students' academic performance. In one study (Zheng et al., 2018), the students in the experimental group had online synchronous discussions after assessing their peers' essays while those in the control group did not. The experimental group outperformed the control group in writing quality, peer feedback quality, metacognitive awareness, and self-efficacy in PA. Similarly, the asynchronous discussions on peer feedback in Kim & Ryu (2013) seemed to contribute to students' confidence and satisfaction and the quality of their instructional design projects.

Research shows that students have a favorable attitude towards discussion. In one study (Yu, 2011), students in a teacher education class conducted PA in one of three modes (one-way, two-way, and multi-way) when they assessed multiple-choice questions that were generated by their peers. The questions pertained to an instructional principle that the students had learned about. Each student generated two questions, and each student assessed four randomly assigned questions. The one-way mode did not allow assessors and assessees to discuss peer ratings and feedback. In the two-way mode, assessors and assessees had conversations about the peer ratings and feedback. In the multi-way mode, online conversations took place between assessors and assessees as well as among multiple assessors. Students preferred the multi-way and two-way modes to the one-way mode because the multi-way and two-way modes yielded a better understanding between and assessors and assessees. These two modes can be particularly useful for online courses.

Research shows that required discussion is more beneficial than optional discussion. In Filius et al.'s (2018) study, assessors and assessees discussed feedback in a discussion forum, but the discussion was optional. Few students participated in the discussion. Student interviews revealed that one possible reason for students' disengagement in the discussion was that it was optional. Another possible reason was that students needed to go to another platform for the discussion.

GUIDELINE 3 (IMPLEMENTATION): PROVIDE STRUCTURE AND USE TECHNOLIGIES TO HELP ENSURE A SMOOTH IMPLEMENTATION OF PA

Providing structure means making expectations clear for students (Connell, 1990) and providing procedures to follow (Reeve et al., 2004), and support, strategies and guidance students can use to complete academic tasks (Connell, 1990; Skinner & Belmont, 1993). Providing structure can enhance students' engagement in academic tasks, intrinsic motivation, and learning outcomes (van Loon et al., 2012). For PA activities, structure can be provided in the form of a script or a template that includes statements or questions to guide PA, criteria that can be used to assess peers' work, elements that high-quality products should include, or information (e.g., definitions and examples of local and global errors) that can help students complete the PA activity. Noroozi et al (2016) used a peer feedback script that included questions to guide the provision of feedback on two peers' argumentative essays and what should be included in high-quality essays. Papadopoulos et al. (2012) provided students with review guidelines that consisted of three questions to direct students' attention to the content, argumentation, and expression of their peers' answers to open-ended scenarios. In M. Gielen & De Wever (2015a), the non-structure group was provided with the evaluation criteria. The basic-structure group received two questions ("What do you like about your peers' work?" and "What would you change in your peers' work?") to guide PA, in addition to the evaluation criteria (p. 318). In another study by M. Gielen & De Wever (2015c), the peer feedback template included four sections: (a) a list of the criteria that could be used to assess their peers' abstracts for scientific papers, (b) a section to provide feedback on how their peers did, (c) a section to make suggestions for improvement, and (d) a section for the writer of the paper to evaluate the quality of the feedback they were given. The PA system Yang (2011) created provided definitions and examples of local and global errors for students who assessed their peers' essays.

How elaborate should the script or template be? Empirical studies show that a basic template that lists the assessment criteria and that reminds students to assess how their peers did and provide suggestions for improvement can lead to effective feedback (M. Gielen & De Wever, 2015a) and improve the quality of students' final products (M. Gielen & De Wever, 2015b). A template that was highly elaborate did not seem to be much more beneficial than a simple one. For example, the highly elaborate template in M. Gielen & De Wever (2015a) and (2015b) asked assessors to formulate feed up (i.e., state the goal), feedback (i.e., assess how peers did), and

feed forward (i.e., offer suggestions for improvement) for each of the ten criteria. M. Gielen & De Wever (2015b) found that the elaborate structure led to feedback of higher quality than no structure did and that the elaborate and basic structure brought about higher product scores than no structure. M. Gielen & De Wever (2015a) found that the basic structure led to more feedback elaborations, but the elaborate structure did not. Findings from the two studies suggest that the elaborate structure was not necessarily more effective than the basic structure.

Technologies, necessary for online PA activities, are of paramount importance for some particular PA activities. For example, without technologies, it is impossible to keep track of who reviewed what when students freely select the work to review, as in Papadopoulos et al. (2012). Although most of the technologies in the literature were created by the research teams (e.g., Author, 2018; Kim & Ryu, 2013; Yang, 2011), there are free technologies that can be used for PA. The students in van Den Bos & Tan's (2019) study used the free online program called Peergrade. Instructors can also use technologies that are not designed for PA but can facilitate PA activities. These technologies include but are not limited to instant messaging and social networking tools. WhatsApp was used for anonymous PA in a study by Güler (2017). The correlation between peer and instructor ratings showed that the PA facilitated by WhatsApp was valid. Blogs were used in Novakovich (2016) and Novakovich & Long (2013) where students provided feedback on their peers' writing. Both studies showed that blog-mediated peer feedback enhanced students' learning outcomes. Additionally, learning management systems can also be used for PA. Mostert & Snowball (2013) used Moodle for anonymous PA in a large-enrollment class.

CONCLUSION

SUMMARY

PA is widely implemented in higher education, and it can play an important role in online learning by connecting students to their peers and enabling feedback from multiple sources. However, peer feedback of high quality is not guaranteed for many reasons, such as students' lack of PA skills, the psychological and social factors that inhibit students' honest feedback, and students' unwillingness to expend effort to provide quality feedback. In addition, students tend not to use peer feedback. In an era in which online learning is ubiquitous, guidelines that can inform instructors on how to prepare for, design, and implement PA are immensely helpful, especially for the instructors who are relatively new to distance education. This paper proposes the above guidelines based on a review of empirical studies that aimed to improve the effectiveness of technology-facilitated PA. These guidelines can help online instructors make PA activities effective.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

One limitation is that almost all the studies reviewed were conducted in face-to-face courses, although the PA interventions were facilitated by technologies. Only one study, Filius et al (2018), was conducted in an online course. Although the technology-facilitated PA studies can provide implications for PA activities for online learning, the interventions in those studies may have different impacts on online students. Future studies are needed to validate the guidelines. Another future research direction is to test and refine the guidelines in a STEM context. Many of the studies reviewed focused on writing and teacher education courses. Students taking STEM courses, such as engineering, physics, and chemistry courses, may have different needs and different attitudes towards PA.

Statements and Declarations

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