

## Article

# Exploring the Impact of Peer Review on Student Engagement in Online Courses: A Future Learn Case Study

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**Abstract:** This study investigates how peer review can be designed and implemented to enhance specific dimensions of student engagement in online courses. To this end, it addresses three progressively connected research questions concerning students' perspectives on peer review, their engagement in peer review, and strategies for leveraging peer review to foster deeper engagement. Using a qualitative case-study approach and inductive thematic analysis, the study analyzes the secondary data collected from Future Learn. The findings reveal five positive attitudes, four major concerns, and four peer review suggestions. While students recognized the value of peer review for the benefits it brought, they were also concerned about some potential problems. They indicated efficient approaches to be integrated into peer review to motivate high quality, positive and deep student engagement. The study's main contribution lies in mapping specific types of student engagement to students' comments on peer review, thereby connecting a multi-dimensional student engagement framework with specific reflections. The results provide valuable indications for all online course stakeholders, including instructional designers, teachers, platforms, institutions, and policy-makers, to better design and implement peer review activities that more effectively support student engagement and enrich the online learning experience.

**Keywords:** Student Engagement, Peer Review, Online Course, Case Analysis

## 1. Introduction

Digital technology has a profound impact on customer behavior, organization, market, and business. Online courses have undergone remarkable development since their emergence and have further gained momentum with rapid technological innovation. Nations, universities, enterprises are investing in this field, hoping to expand the boundaries of education. However, debates and disputes over online courses have been ongoing for a long time. On the one hand, some researchers advocated that online courses, like MOOCs, provide a potential solution for educational inequality, given their capacity to broaden access, increase affordability, as well as teaching-and-learning flexibility, thereby promoting education equality and personalized education, so as to achieve personal development and meet social demands (Thelma & Phiri, 2024). On the other hand, some researchers raised concerns over low completion rate, one-size-fits-all teaching and learning, low student engagement, as well as inadequate assessment of online learning (Dumford & Miller, 2018).

Considering that online courses have penetrated almost every aspect of education and daily life, rather than taking an overly dichotomous stance, it is essential to identify an approach that mitigates their limitations while maximizing their benefits (Dumford & Miller, 2018). Redmond et al. (2018) claim that student engagement could reflect and predict students' experiences. Deng et al. (2020) and Trowler and Trowler (2010) emphasized that student engagement is significant for successful learning, teaching experiences and outcomes. Appleton et al. (2008) argued that engagement is malleable through interventions and could be used to predict and prevent students' dropout as well as facilitate positive learning outcomes. Fredricks et al. (2004) proposed that student engagement might be a potential antidote for low achievement, feeling of alienation, high levels of student boredom and dropout rates, which is critical for the betterment of online learning experience.

The concept of student engagement has gone through a progressive broadening trajectory, from a simple behavioral construct that tailors to the traditional face-to-face educational context, to a multidimensional grounded meta-construct applicable in both online and offline educational contexts.

It is widely considered that student engagement could be traced back to the 1930s when Ralph Tyler emphasized the positive effect of students' time on learning tasks, although the phrase of student engagement was not concretely used by that time ((Kuh, 2009). Astin (1984) raised a student involvement concept that integrates students' learning efforts, interacting with teachers and peers, applying knowledge and skills into concrete tasks. Generally, student engagement might be considered as time, energy and resources that students might devote to learning activities.

Researchers have conceptualized student engagement as either a uni-dimensional or a multi-dimensional concept. Fredricks et al.(2004) suggested that a multi-dimensional understanding that consists of behavioral, emotional, and cognitive engagement, should be specified in the research and practice of student engagement, because it would be supportive to examine the antecedents and consequences of different types of engagement simultaneously and dynamically, allowing for richer individual characterizations and be helpful to investigate the interactive effects. Among scholars who support the multi-dimensional perspective, disputes remain regarding the number (usually 2-4) and types (usually emotional, behavior, and cognitive) of engagement to be included.

Just as Christenson et al., (2012) outlined, the study of student engagement evolved from an initial focus on observable behaviors in the late 1980s and early 1990s; integrated emotional and cognitive dimensions into a multidimensional framework in the late 1990s and early 2000s; further expanded to include agentic engagement and a dynamic, developmental perspective on student trajectories since the 2010s. Another pivotal shift was that research on student engagement has progressively evolved from traditional face-to-face education to online education.

The Online Engagement Framework for Higher Education proposed by Redmond et al. (2018) advocated social, cognitive, behavioral, collaborative, and emotional types in student engagement, with the idea that interactions with teachers and peers were an essential part of student engagement. Differentiating from Fredricks's three-dimensional framework, which was based on face-to-face education, Redmond et al.'s five-dimensional framework presented teaching and learning in online environments. The inclusion of social and collaborative engagement might come from the concern that student-student and student-teacher interactions in online courses were significantly different when compared with traditional in-person education. Such development of the student engagement framework was applaudable because it contextualized student engagement under specific social and educational environments, expanding research in student engagement into both in-person and online education (Redmond et al., 2018).

Based on the five-dimensional framework, Deng et al.(2020) further refined student engagement into a context-based four-dimensional framework, namely the behavioral, cognitive, emotional, and social engagement, merging collaborative engagement into social engagement, which echoed with Laurillard's (2002) conversational framework proposing that collaborative learning is a significant component of social learning. According to Deng et al., the four-dimensional framework proved useful for classifying learners and learning activities, providing tailored intervention and support, and facilitating engagement through scaffolded learning (Deng et al., 2020).

**Behavioral engagement.** Previous research is rich in discussing behavioral engagement forms and quality. In terms of engagement forms, some researchers suggest that behavioral engagement draws on the ideas of involvement and participation in learning activities which is usually readily observable, some focused on asking questions and participating in activities, some emphasized watching videos, while still others refer to attendance and concentration, reviewing and previewing, following rules or risk behaviors (Fredricks et al., 2004, Christenson, L., et al., 2012). It is understandable that behavioral engagement manifests differently across contexts. In terms of degree, positive engagement has been proved to bring about favorable learning experience, such as active class participation, initiative in the learning assignments and activities, enduring efforts, as well as self-regulated learning, which was crucial for achieving positive academic outcomes and preventing dropping out (Fredricks & McColskey, 2012). In contrast, negative behavior engagement or disengagement, such as frequent absence from classes and tardiness in completing tasks (Fredricks et al., 2004), pretending to work and not turning in homework (Fredricks & McColskey, 2012), disruptive behavior like skipping school, disturbing other students, or getting into trouble (Finn, Pannozzo, & Voelkl, 1995) would deteriorate students' interest in learning and risks student retention. Therefore, robust and effective strategies and approaches are needed to stimulate positive behavioral engagement while withering negative aspects.

**Cognitive engagement.** As a multi-faceted conception that draws on the ideas of psychological and mental investment in learning, cognitive engagement integrates motivation, effort, and

strategic learning behaviors (Fredricks et al., 2004, Fredricks & McColskey, 2012). In terms of forms, cognitive engagement is less observable and less easily analyzed than behavioral engagement. However, according to Fredricks and McColskey (2012), several indicators can help detect cognitive engagement: first, it could be elicited from students' beliefs about learning in terms of goals/targets and future aspirations; second, it could be reflected through students' learning strategies about self-regulation and meta-cognition in forms of planning and acquisition; third, preference for the challenge and excelling task requirement in amount and quality are also symbols of cognitive engagement. Though such indicators are subtle, rich context information and subtle interpretation will help to figure them out. In terms of degree, the deep or surface cognitive engagement also captured the attention of researchers (Fredricks et al., 2004; Redmond et al., 2018). By surface engagement, students simply memorize and understand the learning contents, while by deep engagement, students will adopt self-regulation strategies to promote deep comprehension and mastery (Fredricks et al., 2004) through creating connections and exerting mental effort. Such division complies with the cognitive process of the taxonomy of educational objectives, from simple and basic cognition in understanding and remembering, to deeper and more complex levels of applying, analyzing, evaluating, and creating. Therefore, it could be inferred that differentiating levels of cognitive engagement is meaningful for varied learning tasks to provide tailored intervention and improve learning efficiency and effectiveness.

**Emotional engagement.** It refers to students' psychological status and affective reactions, including their feelings, values, and interests. In terms of forms, there are status of feeling interested or bored, happy or sad, relaxing or anxious in learning (Chickering & Gamson, 1987). Some researchers conceptualized students' emotional engagement towards the school as a sense of belonging, identification of self-importance in school, and appreciation and value for the resources and opportunities that schools offer to support students' success and value (Voelkl, 1997); while some researchers focus on the students' emotional reactions towards teachers and peers, be it supportive, constructive, or not (Fredricks et al., 2004); still other researchers emphasized on students' emotional engagement with learning tasks and assignments. In terms of degree, positive and deep emotional engagement with schools, teachers, peers, and tasks are believed to be conducive to strong ties and better learning outcomes (Fredricks et al., 2004).

**Social engagement.** Also known as social presence, this dimension centers on students' social investment and interactions with teachers and peers (Deng et al., 2020). In terms of forms, social engagement may be observed through group study, discussions, meetings, collaboration projects, peer assessment, and online social networks (Redmond et al., 2018). Chickering and Gamson (1987) argued that student-teacher contact and student-student cooperation and reciprocity were among good educational practices that drove good learning experiences and outcomes. Social engagement is comparatively a new concept under the umbrella of student engagement. In terms of function, disputes have been going on for a long time. Proponents highlight that active social engagement motivates students because it could stimulate community building, a sense of belonging, group cohesion through rapport, respect, and trust (Redmond et al., 2018), which may alleviate the feelings of alienation, disconnection, and isolation, thereby reducing dropout. In contrast, opponents are concerned about the information overload and the consequent confusion or chaos caused by such excessive information (Wang et al., 2019).

Summary of student engagement. Amid efforts to conceptualize student engagement, it is recognized that different types of student engagement have their own emphasis and features. For example, behavioral and social engagement are readily observable and identifiable from students' learning activities and interactions with others, while comparatively, emotional and cognitive engagement are usually subtle and covert (Fredricks et al., 2004). This difference explains why behavioral and social engagement are usually used to measure student engagement (Deng et al., 2020). Despite such differences, the four dimensions are not isolated; rather, they are dynamically interrelated and mutually reinforcing throughout students' learning process (Fredricks et al., 2004; Deng et al., 2020). For instance, findings from Fredricks et al. (2004) showed that positive emotional engagement contributed to behavioral and cognitive engagement, which jointly affected learning achievement and outcome.

Besides, the meta-construct of student engagement, which integrates behavioral, emotional, social, and cognitive dimensions, provides a conceptual framework for analysis and intervention. Compared with single construct research, the multi-dimensional perspective provides richer characterization of students and stronger predictive power, enabling researchers to better disentangle the complexities of student engagement (Fredricks et al., 2004). Specifically, the multi-faceted construct could be used to test additive or interactive effects among different components by examining their antecedents and consequences simultaneously and dynamically (Fredricks et al., 2004). Consequently, it becomes possible to diagnose students' learning status, whether progress well or at risk, and design nuanced interventions to enhance engagement and support student success (Deng et al., 2020).

### *1.1 Peer review*

Peer review, also known as peer feedback, peer evaluation, or peer assessment, involves students evaluating and providing feedback to their peers. Within the broader field of student engagement, peer review could be viewed as a reciprocal learning process wherein students simultaneously occupy dual roles as both producers and consumers of feedback. Peer review has been designed and integrated into learning activities as an alternative feedback type to teacher feedback and self-assessment. The benefits and concerns over peer review have invited heated discussion.

The pedagogical benefits of peer review are well-documented. It cultivates students' critical analysis, evaluative judgment, and collaborative feedback literacy through dual roles as reviewer and recipient (Brill, 2016; Nicol, 2014), enhances self-regulation skills, and fosters collaborative learning environments that promote active participation and reflection (Chickering & Gamson, 1987). For large-cohort modules, peer review provides rapid formative feedback at scale unattainable through instructor-only systems (Meek et al., 2017). By making assessment criteria explicit and performance standards transparent, peer review triggers self-regulatory processes and motivation (Bryan & Clegg, 2006a; Gibbs, 2006), thereby fostering deep and active learning while reducing student alienation and supporting a sense of community (Laurillard, 2013). Furthermore, the reciprocal exchange of feedback refines students' self-assessment capabilities, collectively developing a comprehensive skill set that enhances self-confidence and engagement.

However, acknowledging the benefits of peer review does not mean that it is a panacea for online course assessment. Research shows that while peer review was broadly valued among students, its effectiveness might be constrained by participant engagement levels, cultural adaptation needs, and the inherent challenge of eliciting high-quality, constructive feedback from novices (Brill, 2016). Participation willingness, assessment quality, and assessment credibility are among top concerns. From the perspective of the peer review recipient, there are concerns about assessment results. Krause (2013) expressed his disappointment in the peer review feedback from peers, noting that some reviewers did not care about the quality of his writing assignments and the quality of feedback that they offered. Mirmotahari et al. (2019) mentioned that students were skeptical about the peer review feedback they got because they considered that peers were not competent enough to offer constructive feedback. Consequently, students might feel negative about peer review, further deter them from actively engaging in peer review practice. From the perspectives concerning peer reviewers, there are concerns about bias and interpersonal favoritism. Biases relating to gender, race, ethnicity, socioeconomic status, language, as well as interpersonal favoritism, can compromise peer assessment fairness across grade, procedural, and interactional dimensions (Rasooli et al., 2025; Stonewall et al., 2024). What's worse, students' reluctance to critique peers and limited assessment skills disproportionately disadvantage women and minorities, eroding trust in collaborative learning (Rasooli et al., 2025; Stonewall et al., 2024). Such concerns about potential challenges and problems for peer feedback practice demand serious considerations and effective solutions.

### *1.2 The online engagement framework*

To figure out appropriate approaches to measure student engagement, successive studies were initiated. One type is survey. Specifically, surveys that contain students' self-report and teacher ratings (Appleton et al., 2008; Fredricks et al., 2004; Fredricks & McColskey, 2012) are most frequently adopted, such as the National Survey of Student Engagement (NSSE), the Faculty Survey of Student Engagement (FSSE), the Beginning College Survey of Student Engagement (BCSSE), and College Senior Survey (CSS). Survey measures, especially online surveys in questionnaire forms, enjoy merits such as cost-effectiveness, reaching a larger number of audiences, and time-efficiency (Bryman, 2016; Fredricks & McColskey, 2012). However, survey research is susceptible to sampling-related, data-collection, and data-processing errors (Bryman, 2016), and respondents may not always provide candid answers (Fredricks & McColskey, 2012). What's worse, the dearth of contextual information in survey and quantitative analysis limits comprehension and interpretation of the real student engagement conditions (Fredricks & McColskey, 2012). In contrast, qualitative methods offer richer interpretive potential. As Fredricks et al. (2004) note, qualitative methods could enable a detailed illustration of the process, which leaves room for interpreting contexts and constructing meaning within complex and sometimes contradictory situations (Fredricks et al., 2004). Redmond et al. (2018) also advocated that qualitative methods work well in exploring the nature and the quality of engagement. Of course, such a qualitative research method is not without limitations, among which time-consuming is a major concern.

Although no consensus has been reached regarding the precise dimensions or indicators of student engagement, existing measurements could offer valuable insights for the present study.

Given that Deng et al.'s (2020) four-dimensional framework traces back to Redmond et al.'s (2018) five-dimensional Online Engagement Framework for Higher Education, this study contextualizes Redmond et al.'s framework by merging collaborative engagement into social engagement, thereby proposing a revised four-dimensional framework (see Table 1) captures the key elements of student engagement in online learning.

### 1.3 Research questions

In light of the importance of student engagement and peer review in online learning, this study aims to address the following questions:

RQ 1: What benefits and concerns do students perceive in peer review?

RQ 2: What types of student engagement emerge through the practices and processes of peer review?

RQ 3: How can peer review be designed and implemented to promote four key types of student engagement, including behavioral, social, cognitive, and emotional engagement?

**Table 1:** Revise Online Engagement Framework (Redmond et al.,2018)  
the original (left) and the revised version (right)

Element	Indicators (illustrative only)	Element	Indicators (illustrative only)
Social engagement	Building community	Social engagement	Building community
	Creating a sense of belonging		Creating a sense of belonging
	Developing relationships		Developing relationships
	Establishing trust		Establishing trust
Collaborative engagement	Learning with peers	Cognitive engagement	Learning with peers
	Relating to faculty members		Relating to faculty members
	Connecting to institutional opportunities		Connecting to institutional opportunities
	Developing professional networks		Developing professional networks
Cognitive engagement	Thinking critically	Behavioral engagement	Thinking critically
	Activating metacognition		Activating metacognition
	Integrating ideas		Integrating ideas
	Justifying decisions		Justifying decisions
Behavioral engagement	Developing deep discipline understandings	Emotional engagement	Developing deep discipline understandings
	Distributing expertise		Distributing expertise
	Developing academic skills		Developing academic skills
	Identifying opportunities and challenges		Identifying opportunities and challenges
Emotional engagement	Developing multidisciplinary skills		Developing multidisciplinary skills
	Developing agency		Developing agency
	Upholding online learning norms		Upholding online learning norms
	Supporting and encouraging peers		Supporting and encouraging peers
	Managing expectations		Managing expectations
	Articulating assumptions		Articulating assumptions
	Recognizing motivations		Recognizing motivations
	Committing to learning		Committing to learning

## 2. RESEARCH METHODOLOGY

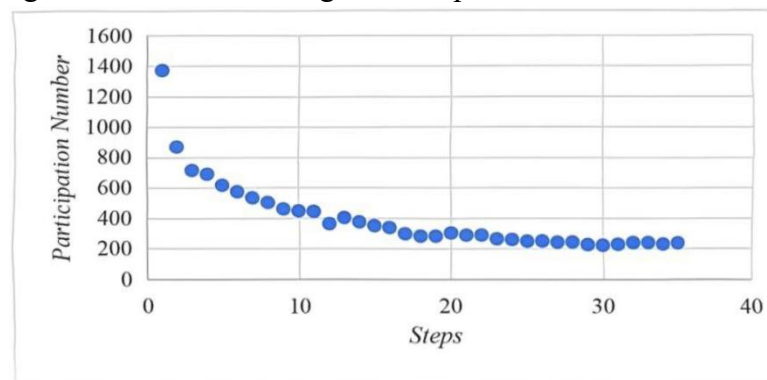
Grounded in social constructivist perspective, this study investigates peer review, student engagement, and the relationship between them in online courses from students' perspectives. A qualitative case study is adopted, with secondary data from Future Learn, and employing inductive thematic analysis supported by NVivo software.

### 2.1 Research settings

To examine how to design and implement peer review so as to improve specific types of students' engagement under the context of online course, this research gathered data from a three-week Blended and Online Learning Design (BOLD) course on Future Learn, a British online course platform established in 2012. The BOLD course was co-offered by Future Learn and the Institute of Education at the University College London (UCL). Since its launch in January 2021, the course has run multiple iterations, enrolling 26,980 learners by November 2025 (Future Learn, n.d.b), and remains available with no indication of discontinuation.

The course consists of three weeks of fully online learning, estimated at four hours per week, and is free to audit with an optional certificate available for £54 (Future Learn, n.d.b). Each week comprises structured learning steps, with 11 steps in week one (from 1.1 to 1.11), 12 in week two (from 2.1 to 2.12), and 12 in week three (from 3.1 to 3.12) (see Appendices about Framework of the LDBO). Comment forums are set under most steps to leave room for students' comments, discussions, reflections and feedback.

The anonymized engagement dataset contains a rich and manageable volume of student interaction data suitable for addressing the research questions. According to the UCL-Future Learn data sharing agreement for research, the engagement data were collected from the forum comments and activity responses in an anonymized manner. In the April run that started on April 5th 2021, 1719 learners registered for the course, and each was allocated with a unique learner-id. Figure 1 represents students' participation in step activities, witnessing a remarkable decline from the 1372 participants in the first step (step 1.1) to 237 participants in the last step (step 3.12). According to the 90%-attendance-as-complete policy of the BOLD course, 115 participants completed 90% of learning activities, contributing to a completion rate of 6.69%.



**Figure 1.** The decreasing trend of activity participation from step 1.1 to step 3.12 (35 steps in total)

Based on such research settings, the BOLD course that was co-offered by FutureLearn and UCL provided rich information and dataset, which laid a solid foundation for examining how peer review might be effectively designed and implemented to enhance specific dimensions of student engagement in online learning.

## 2.2 Data collection and analysis

Secondary data from the BOLD course were used, which was co-offered by FutureLearn and UCL. During this process, a purposive sampling strategy was used; comments concerning peer



(5) Defining and naming themes. Themes were defined and synthesized to address research questions.

(6) Producing the report. Synthesized findings were presented.

Through systematic thematic analysis of exploring, coding, interpreting and reflecting, a small number of core categories or themes were extracted from raw data, to deal with evaluation objectives and research questions.

### *2.3 Credibility: trustworthiness*

Following Guba's (1981) trustworthiness framework, this study ensured credibility through prolonged engagement as a BOLD course participant (from April to May) and triangulation across comments, peer-review assignments, and feedback, minimizing researcher bias through unobtrusive Future Learn data collection. Transferability was achieved via purposive sampling of all learners and peer-review activities and thick description of the research context and methodology to support contextual application. Ethical compliance with UCL, BERA (2018), and Future Learn protocols was maintained through source anonymization, encrypted storage on UCL OneDrive and a password-protected laptop (access restricted to researcher and supervisor), and a one-year post-examination retention period. Direct quotes were avoided in favor of summarized data to further protect participant privacy, and any forum messages containing personal information were disregarded. These measures ensured full adherence to GDPR, BERA regulations, and Future Learn policies while minimizing potential risks to participants.

## **3. Findings and Discussions**

To clarify the findings and discussions, two key factors need to be illustrated. First, in line with Future Learn ethics policies, the current research could not use direct quotes from the data (Future Learn, 2021). Accordingly, the analysis was not restricted, but the reporting was, as the policy did not allow direct quotes to exemplify observations/analysis. To deal with it, detailed interpretation was conducted through analyzing, comparing, contrasting, clustering and summarizing. Second, this research only reported on the occurrence of themes/codes, not on the strength of theme support because of the relatively low number of learners included in the analysis. The relatively low number of learners meant that this case was just a snapshot of a randomly chosen course run. A subsequent iteration could yield a different distribution. Therefore, it could create a false sense of meaning if this research tried to identify the strength of theme support. The value therefore lies in finding out what themes can be observed overall and, due to the enforced lack of direct quotes, it is sensible to present the findings in combination with a discussion.

The data analysis yielded insights into students' perceptions of peer review, student engagement, and how to design and implement to improve student engagement. In general, findings suggested that while students acknowledged and appreciated peer review for the benefits it brought, they were also concerned and worried about some potential problems. Also, the result noted that multifaceted insights and practice in peer review revealed four types of student engagement: behavioral, social, emotional, and cognitive. Moreover, the student engagement reflected in the peer review process and the student's attitude and involvement in peer review indicated that, if designed and implemented properly, peer review could be used to stimulate student engagement

in learning. Together, these findings provided evidence-based answers to all three research questions.

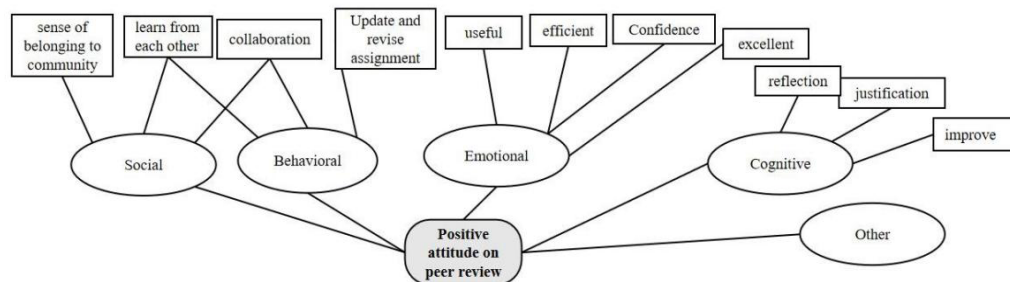
### 3.1 Students' attitudes to peer review

Investigating students' attitudes to peer review could answer RQ 1: What are the benefits and concerns that students have about peer review? Based on the findings from the iterative thematic analysis, the following paragraphs will illustrate detailed information about the findings and discussions on students' attitudes to peer review. Before going further, brief and summative thematic analysis helps to provide some basic understanding of the process.

Following the six-phase guideline summarized by Braun & Clarke (2006), key processes of thematic analysis were implemented. Iterative coding in the thematic analysis process generated concepts, categories and themes at different levels, among which two overarching themes about students' attitudes to peer review were generated. One was positive attitudes to peer review, and the other was concerns and requirements on peer review. At the initial open coding stage, more than 70 nodes were created, covering a wide range of comments and feedback with detailed and nuanced content. Following that, nodes with similar contents were combined after comparing, contrasting and clustering. As a result, more than 20 categories were summarized. Then, after collating the contents and nature of each category, linking them with the research question and prior literature review, further thematic analysis was accomplished. Consequently, more than 20 categories were integrated under the umbrella of four engagement types, which were further condensed under two overarching themes, the positive attitude and the concerns about peer review.

#### (1) Students' positive attitude to peer review

One of the overarching themes comprises learners' positive attitudes toward peer review, represented through five findings that illuminate the perceived benefits of participating in peer review (see Figure 4).



**Figure 4.** Positive attitudes on peer review

First, positive attitude on peer review from behavioral aspect. Students presented that peer review encouraged them to complete assignments, exchange ideas with other learners, and update and revise assignments with a clearer understanding of the criteria and standards. Such presentations highlighted that peer review motivated students to take active actions to involve and participate in learning activities, aligning with Stepanyan et al. (2009), who observed that peer review could motivate students to compare, clarify and contrast their own work with others, as well as diagnose, consider the knowledge and summarize information through access to other students'

work. Such active learning is among the seven principles of good practice in undergraduate education (Chickering & Gamson, 1987), broadening students' perspectives and enhancing the quality of their assignments.

Second, positive attitude on peer review from the cognitive aspect. Students mentioned that peer review stimulated them to reflect on their own assignment, justify their choice, and explore a better approach to improve their tasks, which helped them internalize learning contents and gain deeper engagement in learning (Nicol, 2014). This finding is consistent with Mulder et al. (2014), who argued that peer review plays a constructive role in students' self-assessment skills and self-review ability through providing and receiving peer review and feedback. During the reciprocal processes, students are driven to self-evaluate and self-review consciously and unconsciously, which promote reflection, justification and exploration in the assignment and knowledge domain. Furthermore, self-regulation and learning motivation could also be stimulated during this process, which could enhance students' learning experience, assist with deep and active learning (Dixson, 2010; Stepanyan et al., 2009).

Third, positive attitudes on peer review from the emotional aspect. Other students described peer review as useful, excellent, beneficial, and marvelous, promoting that peer review contributed to students' confidence in learning. This aligns with Theising et al. (2014), who found that peer assessment positively impacts learning behaviors and self-confidence by helping students identify strengths and limitations in their own assignments.

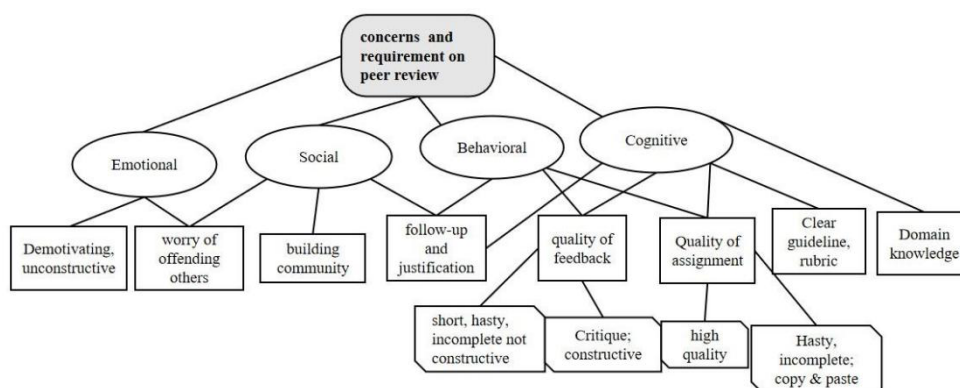
Fourth, positive attitude on peer review from the social aspect. Students indicated that peer review enhanced the sense of belonging to the learning community, enabled students to learn from each other, and stimulated collaborative learning. Such a finding is consistent with remarks that peer review enhances interactions among students, alleviates the sense of alienation and enables the formulation of a learning community, which could 'contribute to a more collaborative and participatory learning environment (Dixson, 2010; Mulder et al., 2014). During this process, peer review empowers students with transferable skills, such as critical thinking, communication skills, empathy, and teamwork because instead of individual efforts, peer review encourages social learning with other students and judgment made on other students' assignments (Meek et al., 2017; Morris, 2001).

Fifth, positive attitude on peer review from other aspects. Students noted that peer review supplemented teacher feedback and self-assessment, creating high student engagement and helping to lower inhibition. Such findings are critically important because it proposes a potential and potent solution for the thorny tensions between limited resources and increasing cohort sizes in online courses (Mulder, Baik, et al., 2014; Nguyen et al., 2020; Ramsden, 2003). By facilitating timely feedback exchange, peer review alleviates teachers' workload, encourages active student involvement, and reduces the risk of dropout.

To sum up, it is really meaningful to recognize the benefits and positivity of peer review from the five aspects mentioned above. Equally important is examining the concerns and worries associated with peer review.

## (2) Students' concerns and requirements about peer review

Students' concern about peer review was the second overarching theme that emerged from the thematic analysis, which contained four findings indicating some limitations and weaknesses that affected peer review quality (see Figure 5).



**Figure 5.** Concerns and requirements on peer review

First, concern about peer review from the behavioral aspect. Some students expressed concerns about some feedback that was hasty, busy and short, without constructive comments or suggestions. For example, several feedback were offered with simple contents like yes, great, I think so, etc. Some even copied and pasted the feedback requirement or provided feedback that was totally irrelevant to the feedback guideline requirement, which demotivated some students. Such a concern resonated with Krause (2013)'s disappointing experience because the feedback that he got revealed that some reviewers did not care about the quality of his writing assignments and the quality of feedback that they offered. Moreover, if students were not actively engaged in peer review, the feedback and assessment might be misleading or inaccurate (Bryan & Clegg, 2006). Such low-quality feedback hinders effective collaboration, limits opportunities for learning from peers, and contributes little to assignment revision.

Second, concern about peer review from the cognitive aspect. Some students emphasized that clear rubrics and guidelines, along with a solid understanding thereof, were essential for learners to both provide and integrate received feedback. In addition, students also posted that some reviewers might misunderstand the submitted assignment due to lacking contextual information or domain knowledge, which resulted in incompatible feedback. According to the peer-review feedback posted in the comment forum, many students did not follow the rubric and guidelines when submitting assignments and providing feedback, leading to various problems. Such conditions could be partly explained by Meek et al. (2017) that low-quality assessments are highly likely to be attributable to the uneven assessment caused by learners' diverse backgrounds, disparity of abilities, as well as different intentions. In addition, the background and experience of peer raters also made students skeptical about whether peers are competent enough to offer constructive feedback (Mirmotahari et al., 2019).

Third, concern about peer review from the emotional aspect. Some students stated that peer review was sometimes demotivating and unconstructive, especially when offering feedback to low-quality assignments and receiving poor quality feedback. Besides, several students also indicated that, in many cases, learners were not open and professional enough to offer feedback because they were afraid of offending others or criticizing others. Still others were concerned about the subjectivity among peer reviewers, which might reduce the fairness of feedback, especially when such a peer review result was included in the final grade. Such concerns were also reflected by Bryan & Clegg (2006) that if students are not actively engaged in peer review, the feedback and assessment might be misleading or inaccurate. In addition, subjectivity in peer review, such

as interpersonal favoritism, compromise peer assessment fairness across grade, procedural, and interactional dimensions, threaten the fairness and justification of assessment and deteriorate students' trust in peer review.

Fourth, concern about peer review from the social aspect. There were concerns about the learning community, feedback follow-up loop, and relationships between peers. Specifically, students pointed out that one pre-requisite of effective peer review largely depended on a collaborative community that could entail collaboration and sharing, feedback and follow-up. However, under the context of the BOLD course, an online course with a large number of participants and a low completion rate, it wasn't very likely to establish an efficient and effective learning community that ensures smooth and quality peer-review among learners. As was pointed out by Sharif & Magrill (2015), the discussion forum offers global peer-to-peer interaction, creating a "network of cross-cultural sharing and collaborative problem-solving". However, they also highlighted that online courses without cohort structures often struggle to generate meaningful user-created content.

To sum up, students expressed their concerns over the feasibility and quality of peer feedback from different aspects, hoping to receive attention and proper solutions so as to improve peer review quality, motivate student engagement in learning, and ultimately contribute to better learning outcomes, and potentially reduce dropout rates.

### *3.2 Types of student engagement reflected in peer review*

Apart from exploring students' perspectives on the benefits and concerns about peer review, the thematic analysis findings also shed light on different types of student engagement, namely the behavioral engagement, cognitive engagement, emotional engagement, and social engagement. Accordingly, this part will elaborate on RQ 2: What types of student engagement emerge through the practices and processes of peer review? The following paragraphs will be delineated with detailed analysis findings, some interesting and contrasting findings with former studies, as well as potential interpretations.

In general, five positive findings and four main concerns were delineated during the process of unveiling students' attitudes towards peer review, which could generate some interesting discussions when bridging up with different types of student engagement. To be specific, the first four findings about positive attitude and the four concerns that students expressed towards peer review formulated one-one correspondence with the four types of student engagement, which invited in-depth discussion.

#### *(1) Behavioral engagement*

As mentioned in the first finding of students' positive attitude to peer review, students were encouraged to complete assignments and exchange ideas with other learners, which contributed to their deepened and more precise understanding of the criteria to better update and revise their assignments. In contrast, in the first finding of students' concerns over peer review, students denounced peer feedback that was hasty, short, irrelevant to the rubric and criteria, and unconstructive, which deterred them from engagement in peer review and relevant learning activities.

Such findings showed that in peer reviews, students react differently under positive or negative attitudes. Specifically, positive attitudes had potential motivational force to engage students in actions, such as understanding and following rubrics, involving and participating in learning

activities, and updating and revising assignments. Vice versa. Such reactions complied with essential elements of behavioral engagement, which according to Fredricks et al. (2004), emphasized involvement and participation in learning activities, including attending sessions, following rules, reviewing tasks, and completing assignments (Deng et al., 2020a; Fredricks et al., 2004; Fredricks & McColskey, 2012; Young, 2009).

The findings further indicate that positive and negative behavioral engagement also made a significant difference in determining students' qualitative levels of engagement. For example, in the process of completing learning assignments, some learners proactively followed the guideline and submitted assignments accordingly, while some other students muddled through the learning assignment, duplicating the assignment requirement or submitted assignments irrelevant to the assignment requirement. Similarly, in the process of providing peer review feedback, some participants provided detailed and critical feedback with constructive suggestions. In contrast, other participants provided feedback in a hasty and perfunctory comments such as "yes," "great," or "I think it's OK." In this way, this research provided evidence that the type of submission/feedback covered a broad range, instead of answering the question of why students provided perfunctory assignments and comments.

From learners' comments on peer-review feedback, it could be seen that positive engagement and a high qualitative level of engagement were highly appreciated by peers. Most of the feedback was regarded as constructive, helpful, and useful. Such feedback revealed that positive engagement brought about favorable learning experiences and was considered crucial for achieving positive academic outcomes and preventing dropping out (Wang et al., 2019; Fredricks & McColskey, 2012). On the contrary, negative behavioral engagement generated unconstructive, demotivating feedback, highlighting the critical role of engagement quality in shaping learning outcomes.

## (2) Cognitive engagement

According to the second finding of students' positive attitude to peer review, through reviewing other students' assignments, learners were stimulated to reflect on their own tasks, justify their choice, interpret the guidelines, and explore ways to improve their tasks to excel former ones. Such practices are usually motivating and stimulating for self-regulated learning and deepened active learning (Stepanyan et al., 2009; Dixson, 2010; Mirmotahari et al., 2019). In contrast, the second concern revealed that peer feedback could be inconsistent with learning tasks and rubric requirements due to reviewers' uneven cognitive backgrounds or misunderstandings stemming from limited domain knowledge (Meek et al., 2017). Consequently, students would become skeptical about the competency of their peers (Mirmotahari et al., 2019).

These findings indicated that, to a more or less degree, during the process of offering and receiving peer review feedback, students usually invest psychological and mental efforts in self-regulation and metacognition in the process of planning and acquiring feedback so as to challenge themselves and excel their task requirements (Fredricks & McColskey, 2012). Such efforts echoed with main concepts in cognitive engagement, which emphasized cognitive efforts in psychological and mental investment in learning, (Fredricks et al., 2004; Wehlage et al., 1989; Young, 2009) including motivation, efforts, and strategy use (Fredricks & McColskey, 2012, p. 772).

From the research findings, it could be identified that different levels of cognitive engagement, deep engagement or surface engagement (Fredricks et al., 2004; Redmond et al., 2018) were embodied through students' forum comments and peer-review feedback. To be specific, some

students performed deep engagement in the peer review and learning activities through connecting assignment requirements and peer feedback guidelines critically and constructively, which deepened their comprehension and mastery of domain knowledge and peer review skills (Fredricks et al., 2004). For example, when examining other students' assignments, students with deep engagement usually support their evaluation with critical and constructive details. When they acknowledge the assigned peer-review tasks, they typically follow the patterns of agreeing with reasons, agreeing with suggestions, or agreeing with questions instead of merely commenting yes or good. If they disagree with assigned peer-review tasks, they usually provide explanations and alternative tips. Such deep cognitive engagement invited self-regulation, metacognition as well as significant psychological and mental investment, which benefits both the feedback giver and receiver. In contrast to deep engagement, the surface engagement took fewer efforts in memorizing and understanding simple contents, with limited efforts in higher and complex levels of learning engagement in applying, analyzing, evaluating, and creating (Krathwohl, 2002). Consequently, both feedback givers and receivers derived little benefit from such interactions.

### (3) Emotional engagement

Based on the third findings of students' positive attitude to peer review, many students described peer review as useful, excellent, beneficial, and marvelous, promoting that peer review contributed to students' confidence in learning. However, according to the third finding of students' concern over the limitation and shortcoming of peer review, some students felt disappointed and demotivated towards some feedback. Such findings highlighted that students' emotional status and affective reactions have a significant influence on learning participation and outcome, which resonated with the main contents of emotional engagement, emphasizing students' psychological and mental status, emotions and feelings, during the learning process (Mandernach, 2015).

Emotional engagement encompasses students' affective reactions and psychological states during learning. One perspective focuses on general emotions such as interest, enjoyment, or anxiety (Skinner & Belmont, 1993), while another emphasizes emotional reactions to specific targets, like teachers, classmates, institutions, and learning tasks (Lee & Smith, 1995; Stipek, 2002; Fredricks et al., 2004; Fredricks & McColskey, 2012; Young, 2009).

According to some remarks, some students who got constructive and useful feedback treated their peers as critical friends or trusted peers; and they also pointed out peer review was an efficient way to complement teacher feedback, especially under the massive global scale course context. Such positive emotions and perspectives strengthened the learning community, enhanced students' sense of belonging, augmented students' self-importance, and improved students' appreciation and value for the resources offered by the course, which were critical for students' success (Voelkl, 1997). In contrast, some negative emotions resulted from low-quality, unconstructive, subjective, unprofessional or unserious feedback hindered students' appreciation for their peers. For example, some students were worried about criticizing other students' assignments because they were cautious about offending their peers. Consequently, it led to a result that many feedback did not contain real and authentic feedback. For another example, interpersonal favoritism (compromised peer assessment fairness across grade, procedural, and interactional dimensions) was also indicated by some students (Rasooli et al., 2025; Stonewall et al., 2024). Such factors undermined trust in peer review, reduced fairness, and negatively affected emotional engagement.

### (4) Social Engagement

According to the fourth finding about students' positive attitude to peer review, many students posted that peer review enhanced the sense of belonging to the learning community, enabled them to learn from each other, and stimulated collaborative learning among peers. On the contrary, some students voiced their concerns about collaborative learning community establishment and maintenance, the follow-up loop for feedback communications, as well as the loose relations among learners, which was delineated in the fourth finding about students' concern over peer review.

These contradicting perspectives, which center on learning with peers, teachers, and within broader learning contexts, reflect key elements of social engagement (Deng et al., 2020a). Given the particular reality of online course context, which featured large scale, open, flexible, a discussion forum is usually designed as the primary approach that entails students' social engagement (Sharif & Magrill, 2015). In the current research, students' comments and feedback on peer-review were collected from such discussion forums.

Apart from benefits and concerns about students' social engagement in peer review and other learning activities, interesting findings emerged during the thematic analysis process. In general, the four types of student engagement, instead of being separated and isolated, have dynamically interrelated and interwoven throughout students' peer review experience (Fredricks et al., 2004; Deng et al., 2020a). To be specific, social engagement is closely intertwined with the other three types of engagement. In terms of creating a learning community, social engagement shared some commonality with that of emotional engagement. Besides, in terms of entailing the sense of belonging to the community and reducing the sense of alienation through interactions with peers, social engagement had some similar features to that of emotional engagement. In terms of collaborating with peers to provide feedback and receive feedback, social engagement could be connected with behavior engagement. Therefore, the boundary between social engagement and other types of student engagement is not hard-and-fast; instead, it should be flexible under different contexts and to meet different objectives.

From the above findings and discussions, it could be concluded that four types of student engagement were all embodied through the comments and feedback on peer review. Besides, contradictory opinions concerning the four types of student engagement entailed an objective and rational understanding of the relationship between peer review and student engagement. Moreover, the multi-dimensional student engagement disentangled the complexities of student engagement (Fredricks et al., 2004) which was critical for a nuanced understanding of students' learning experience. Under such circumstances, it is necessary to explore how to utilize peer review to promote student engagement under the context of online course from the perspective of students.

### *3.3 Peer reviewing approaches that promote engagement*

This section addresses RQ3, which examines how peer review promotes behavioral, social, cognitive, and emotional engagement. Till now, findings about students' attitudes to peer review, as well as specific types of student engagement have been described and discussed. Accordingly, RQ1 and RQ2 were answered. Findings and discussions on these two research questions shed some light on the RQ3, because the overarching principle is that benefits of peer review should be advocated, while concerns and limitations need to be appropriately dealt with. On top of that, specific coding and findings were found to deal with RQ3, which will be elaborated on in the

following part. Thus, RQ3 will be illustrated based on learner contributions, in combination with a synthesis arising from the consideration of literature in the discussion.

(1) Provide clear and understandable guidelines and rubric

Clear and understandable guidelines and rubrics were acknowledged to be essential pre-requisites and foundations for student engagement. According to the coding and theming process, students frequently mentioned the significance of clear guidelines and rubrics. They proposed that the rubric provided by the LDBO served as a roadmap to direct feedback providers through necessary steps with specific requirements. It also functioned as a checklist to guide peer-feedback receivers to reflect and update their assignments. Such propositions aligned with Meek et al.'s (2017) claims that to ensure the quality of assessment results, clear and well-understood rubrics, and grading standards plays a fundamental role in enabling reviewers to make a global judgment with validity and reliability.

Students further suggested that rubric should be designed with attention to the characteristics and prior knowledge of participants to enhance comprehensibility. This insight resonates with Dawson's (2017) comprehensive framework outlining 14 critical elements of effective rubric design, namely the specificity, secrecy, exemplars, scoring strategy, evaluation criteria, quality levels, quality definitions, judgment complexity, users and uses, creators, quality processes, accompanying feedback information, presentation, and explanation.

Driven by clear and understandable rubrics and guidelines, students could engage more fully and positively in peer review because they know what is expected from the feedback. And if the rubric is followed by exemplary feedback, it would be better for students to get a more direct understanding of peer review standards. In this way, it is highly possible that students would become more willing to participate in peer review practice and become more confident in providing critical and constructive feedback.

Consequently, behavioral engagement and emotional engagement are improved. Moreover, with a clearer understanding of rubric and guidelines, students could reflect on their own tasks and conduct further self-assessment to justify and modify their own tasks, which would deepen their understanding and benefit deep level cognitive engagement. Last but not least, with clear and understandable rubrics and guidelines, constructive, critical, professional or serious feedback will benefit high-quality interactions among students, which encourages positive and deep social engagement.

(2) Leave room for student autonomy in peer review participation

Respecting students' autonomy in deciding whether to engage in peer review activity or not was also highlighted. Several students noted that meaningful and professional feedback requires time, focus, and intrinsic motivation, yet many peers might be overwhelmed by work or family commitments. To deal with this situation, students should be allowed the freedom to decline or accept participation in peer review practice. Under such circumstances, students who decided to involve in peer review activities were believed to have higher potential and motivation to give serious and professional feedback, which contributed some constructive and critical feedback. Even students who decided not to participate in peer review would also benefit from the freedom they were fostered. Meanwhile, students who opt out can pursue their individual learning goals without negatively affecting others' processes.

This perspective aligns with Su & Reeve's (2011) conceptualization of 'autonomy is the inner endorsement of one's behavior' and 'when people experience autonomy need satisfaction, they function more positively and experience greater psychological well-being'(p.160). Thus, it could be indicated that leaving room for student autonomy has the potential to enhance students' cognitive engagement and emotional engagement. According to the suggestions of effective autonomy-supportive intervention, offering choice was among the five conditions (Su & Reeve, 2011), which could be used in peer review design and implementation.

Such autonomy in choice caters to the fact that a large proportion of students might not want to have deep engagement in online courses resulted from varied intentions and expectations of taking online courses (Deng et al., 2020). Thus, it is highly possible that they are not willing to engage in peer feedback activities. However, if forced to participate, short, hasty, irrelevant or unconstructive feedback would be generated, which is inconsistent with the original goals of peer review. What's worse, such negative engagement and unconstructive feedback in peer review might mislead or demotivate students who were serious about the assignments and feedback (Gibbs, 2006). Thus, it is a good idea to leave students autonomy in deciding if he/she wants to participate and follow rubrics. Students who are willing to engage could have the opportunity to review the students' assignments, provide constructive feedback to others, receive critical feedback, reflect, justify, and modify their own tasks. In this way, it is a hope that with autonomy support, students could enjoy the positive and deep level behavioral, emotional, social and cognitive engagement.

### (3) Use grouping strategy to match users

The findings also showed that several students thought that lacking domain knowledge from either feedback providers or receivers limited the quality of feedback. One feedback provider pointed out that although he/she had completed the feedback for other students, he/she doubted the objectivity and professionalism of the feedback that he/she had provided because of lacking specific knowledge in that subject. Another feedback provider also proposed that, with limited familiarity with the topic and relevant requirements, the feedback that he/she provided might lack criticism and constructiveness. There were also students worried about how the quality of feedback could be ensured if the peer reviewer was a weak young learner. These concerns implied a clear expectation: peer reviewers should be matched based on relevant knowledge or background to ensure high-quality feedback. Such a grouping strategy is applaudable from some aspects. First and foremost, as stated by Chickering & Gamson (1987), 'learning is enhanced when it is more like a team effort than a solo race' (p.3). Grouping learners who share similar domain knowledge is likely to lead to more informed, nuanced, and critical feedback. Such feedback could stimulate students to be involved in deep cognitive engagement through reflection, justification, criticism, and objectiveness. Besides, the grouping strategy will also improve students' trust in their peers, motivate them to provide higher quality assignments and feedback, strengthen the ties between learners, which will benefit behavioral, emotional, and social engagement.

Grouping strategy in itself was meaningful with convincing merits. However, launching and implementing such a grouping strategy needs detailed plans and verification, considering the massive student body with diversified social, educational, economic backgrounds, varied intentions, and potential family, work or study obligations. According to Huang and Wu (2011), an effective and systematic learner grouping scheme that contains the processes of learner portfolio, portfolio

grid, learner similarity matrix, and group composition might provide a potential solution for the online course grouping strategy. Such an approach could offer a feasible solution for large-scale online environments—allowing students to benefit from both the diversity of a global learning community and the supportive alignment of domain-specific peer groups.

#### (4) Enhance dialogue mechanism for peer feedback

Many students emphasized the need to establish a mechanism that facilitates two-way dialogue between feedback receivers and providers. From the receiver's perspective, a student suggested that if the name and contact information of the feedback provider was available, he/she could follow up to gain more constructive and detailed information. From the provider's perspective, a student voiced that the feedback provider also wanted to get feedback from receivers so as to know if their comments and suggestions were helpful or not, and they also wanted to have conversations with feedback receivers to get their justifications. Thus, from the perspectives of both sides, entailing a mechanism that could bridge peer-feedback receivers and providers is meaningful in extending students' communication, discussion, collaboration and reflection. Establishing and enhancing dialogue has also been promoted by Laurillard (2013) suggests that instead of treating communication as a one-way process in which teaching means telling, iterative dialogue should be encouraged at the student-student scale as well as the student-teacher scale. Similarly, Nicol (2010) also proposed that receiving comments and feedback once for a completed assignment is not enough for students; instead, following up discussions and dialogues are necessary.

In large-scale online courses where teachers face significant workload constraints, peer feedback and dialogue could be capitalized on, which could benefit students with peer critiquing, collaborative assignment production, noticing other students' dialogues (Nicol, 2010). The transferring from monologue to dialogue in peer feedback helps students reach agreement while also noticing varied viewpoints (Laurillard, 2013). If peer-review-related tasks or online courses as a whole could integrate such a mechanism into the design of the course, students would be highly possible to better engage in learning activities behaviorally, emotionally, cognitively and socially. However, given the massive scale of learners in online courses, ensuring the operation of such a mechanism is worth further consideration.

In sum, students emphasized the significance and potential of four approaches, including clear and understandable rubrics, autonomy-supportive participation, grouping strategy, and peer-feedback dialogue mechanism. When properly designed and implemented, these approaches promise meaningful benefits for all stakeholders, including students, teachers, course designers, platform providers, and policy-makers.

## 4. CONCLUSION

This study investigated three research questions concerning students' perspectives on peer review, engagement, and the design and implementation of peer review to improve students' engagement within the context of an online course. Under the qualitative case analysis, the integration of four-dimensional student engagement concepts and peer review provided rich characterization of students and greater predictive power to disentangle the complexities of student engagement (Fredricks et al., 2004). The findings addressed the research questions through rigorous the-

matic analysis, revealing: 1. students' positive attitudes toward peer reviews alongside their concerns; 2. four student engagement types that were reflected through peer review; 3. four key student-generated suggestions for designing peer review to improve student engagement.

#### *4.1 Rationality and contribution*

Several considerations highlight the value and contributions of this research. First, this study could exemplify how others could replicate a similar case study with data that is usually easily obtainable (secondary data) without the need for further arrangements and ethical considerations. Consequently, this data strategy makes it possible to research with reduced cost and time input, offers the opportunity to conduct a longitudinal study, and enables cross-cultural analysis (Bryman, 2016). At the same time, challenges inherent to secondary data, such as limited familiarity with datasets, data complexity, and uneven data quality, indicate that careful data selection and quality control remain essential.

Second, this research employed a qualitative case study design that foregrounded thematic occurrence over numerical prevalence. The online BOLD course was purposively selected for its texts that contain nuanced information about peer review and student engagement, enabling in-depth examination of engagement mechanisms that broader sampling might obscure. This approach avoided premature quantification that cohort variations could render misleading, instead establishing a foundational thematic map. Future longitudinal research across multiple course iterations could profitably investigate both theme emergence and prevalence.

Third, the study contributes to the field by clarifying specific types of student engagement are clarified through students' comments on peer review, bridging the multi-dimensional student engagement and peer feedback. In addition, based on the multi-dimensional student engagement and peer feedback, the findings also suggest that peer review could encourage and improve student engagement if appropriately designed and implemented. Specific suggestions and approaches were elaborated, which are meaningful for bettering students' learning experience, improving learning outcomes and reducing dropout rates. These insights provide valuable guidance for course designers, online course teachers, online course platforms, and policy-makers involved in online education.

#### *4.2 Limitations*

While recognizing the rationality and contribution of the current research, three major limitations in the current research should be noted in future research. First, the research was based on secondary data from the BOLD, an online course co-provided by FutureLearn and UCL, with peer review designed and implemented. Thus, such data was proper for the nature and objectives of the current research. However, considering that the comments and feedback on peer review were not designed specifically for the present research, some nuanced information might be missing from the collected secondary data. For example, data for step 2.7 and step 3.7 was not collected by Future Learn. These missing components may have contained students' direct reflections on their peer review experiences.

Second, the study faced an inherent tension between ethical requirements and the level of detail permissible in reporting. Due to Future Learn's research policy of confidentiality and pri-

vacy, this research could not directly quote students' words when presenting the research. Considering that ethics was an essential part of research to be respected and complied with when introducing the analysis and findings of this research, students' perspectives, comments and feedback were interpreted through paraphrasing or summarization. Thus, a compromise and balance between research ethics and research presentation were achieved.

Third, the study analyzed only forum posts and peer review submissions, which, although highly relevant to the research questions, capture only part of the broader learning ecosystem. Important aspects of student engagement and perceptions of peer review may unfold in other learning activities, interactions, or contexts not accessible through this dataset. This limitation may constrain the scope and diversity of student perspectives on student engagement, peer review, as well as insights on how to better design and implement peer review to boost student engagement and improve learning outcomes.

### 4.3 Suggestions

In light of these limitations, several recommendations may guide future research. First, data sources could be expanded and diversified. For example, there could be learning activities in a future online course to collect students' perspectives, comments, and reflections on peer review, using pre-course and post-course surveys, or pre-peer-feedback and post-peer-feedback surveys. In addition, to complement secondary data, some primary data through interviews could also add value to specific research questions. Analysis of such multi-dimensional data with diversified perspectives, comments and reflections could enable deepened understanding about student engagement and peer review, which could lay a solid foundation for better integration of these two in rigorous teaching and learning activities so as to improve students' engagement and better learning outcomes.

Second, future studies could integrate direct quotations with researcher interpretation to make the analysis and findings more convincing. Where the inclusion of verbatim student statements is necessary, researchers may obtain informed consent from participants, enabling the use of quotations while upholding ethical standards. Such an approach would enrich contextual detail, strengthen the interpretive validity of findings, and support more nuanced theorization.

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