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Research Article

Blended MOOCs in higher education: Analyzing student interaction and satisfaction

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ABSTRACT

Blended massive open online courses (bMOOCs) have emerged as a potential educational model that combines conventional in-person instruction with online learning. The investigation into students' level of interaction in bMOOCs is significant to the effective implementation of bMOOCs in higher education. This study investigates the perceived level of student interaction with their peers, instructors, content, and technology in bMOOC environments, the relationship between their interaction and satisfaction, and ways of enhancing student interaction. This research employs a mixed-method data collection approach, including qualitative semi-structured interviews and quantitative data analysis, with the participation of 339 students at a higher education institution in Vietnam. The findings reveal that students' perceived level of interaction was quite high. Student interaction in offline classes was preferred to the massive open online courses environment. Besides, student interaction types and their satisfaction were positively correlated. The paper also addresses possible suggestions for maximizing student interaction in bMOOC environments and practical implications for educational practices in higher education.

Keywords: blended learning, MOOCs, interaction, Coursera

INTRODUCTION

The popularity of online courses is on the rise due to advancements in computer and network technologies (Cho & Byun, 2017). While gaining popularity in affluent countries, this phenomenon is limited to tertiary educational establishments in underdeveloped nations due to the costs and inequities in educational access (Gulati, 2008). Renowned and qualified instructors at prestigious universities such as Harvard, Stanford, Cambridge, and Oxford lead high-quality courses and programs. They have effectively implemented strategic and pedagogical approaches in their classes to enhance the quality and longevity of the educational system. To ensure the quality of education and learning, developing countries must overcome these challenges (Gulati, 2008). Massive open online courses (MOOCs), released in 2008, have revolutionized the landscape of online education. MOOCs aim to aid emerging or disadvantaged nations in tackling pedagogical, strategic, and economic challenges in higher education (Sancho Vinuesa et al., 2015). In response to the COVID-19 epidemic, there has been a focus on shifting traditional classrooms to a technological alternative using MOOCs to maintain educational progress (Salas-Rueda et al., 2022). Distance learning has emerged as a widespread global trend in formal education, aiming to streamline the process. Blended MOOCs or MOOC-based blended (bMOOCs) learning has become a prominent method of instruction in various academic environments, where a combination of online and in-person courses is utilized, following the COVID-19 epidemic. bMOOCs, a new educational trend, have been increasingly popular in higher education institutions, leading to a significant increase in bMOOCs at the tertiary level.

Moreover, studies indicate that over 90% of individuals who participate in MOOCs drop out (Reparaz et al., 2020). One factor contributing to the low completion rate of MOOCs is the continued use of a centralized learning approach that is focused on the teacher (Yousef et al., 2015). Moreover, MOOCs are limited by the

provision of educational evaluation and feedback (Elizondo-Garcia & Gallardo, 2020). The failure can be attributed to the limited duration of direct communication and the extensive amount of content in a MOOC (Mohamed & Hammond, 2018). Instructors play a vital role in promoting learner engagement and interaction, as well as guiding learners through learning materials (Sari et al., 2020). Therefore, examining the level of interaction for the effective implementation of MOOCs in blended learning (BL) is vital. In the context of the study, bMOOCs provided by Coursera or BL using Coursera MOOCs are the focus. The study aims to investigate the level of interaction in the bMOOC environment, perceived by university students, correlations between student interaction and satisfaction as well as possible solutions to enhance student interaction in bMOOCs using Coursera. The study is to seek answers to the following questions:

RQ1: To what extent do university students interact with other students, their instructors, the content, and technology in bMOOCs?

RQ2: What are the relationships between student interaction and their satisfaction with bMOOCs?

RQ3: What are the challenges in student interaction and suggestions to improve student interaction in bMOOCs?

LITERATURE REVIEW

Blended Learning and bMOOCs

BL refers to the combination of traditional in-person teaching and online learning methods within a course (Wong et al., 2014). BL has been implemented in numerous educational institutions due to its advantages, including enhanced student engagement, increased interaction, and improved student perseverance and commitment, as compared to traditional e-learning (Edward et al., 2018; Ghadiri et al., 2013; Ismail et al., 2018). Moreover, BL is versatile for both students and teachers as it enhances students' ability to study independently and yields positive outcomes, while also fostering a sense of harmony and coherence between traditional and online education (Spring et al., 2016).

A bMOOC refers to the integration of MOOC-based technologies into conventional classroom environments. In this approach, teachers may create their own MOOC materials or utilize pre-existing ones that have been designed by MOOC experts. The bMOOC paradigm has the potential to enhance student-centered learning, facilitate interactive video lectures, promote human connections inside the MOOC environment, and accommodate various patterns of MOOC participants (Yousef et al., 2015). Additionally, it can deliver efficient evaluation and constructive criticism. Incorporating bMOOCs into traditional teaching methods may allow lecturers to allocate more time for interactive discussions and collaborative problem-solving during in-person lectures (Estévez-Ayres et al., 2015). Consequently, students expressed their satisfaction with bMOOCs in their courses as they intended to continue to take MOOCs in the BL environment (Ho et al., 2022).

Interaction in Blended Learning Using Coursera MOOCs

Interaction has proven to be beneficial in distant education settings, particularly in the context of online learning and hybrid learning. According to Moore (1989), interaction plays a crucial role in the design of distance education, which is categorized into three types of interaction: student-student, student-content, and student-instructor. Hillman et al. (1994) added the fourth type of interaction, which is known as learner-interface or also called student-technology interaction since it is essential to navigate the importance of technology in the interactive learning environment. Therefore, interaction types in bMOOCs in the study are classified into four types: student-student interaction, student-instructor interaction, student-content interaction, and student-technology interaction.

Student-Student Interaction

Student-student interaction refers to the engagement between a student and other students, whether individually or in groups, in a classroom setting, with or without the presence of a teacher (Moore, 1989). Computer-mediated communication or computer conferencing is utilized as an instructional approach to facilitate learner-learner engagement, enabling students to engage in interactive conversation (Lamy &

Hassan, 2003; Lee & Gibson, 2003; Li et al., 2023). Furthermore, lack of peer interaction in the online learning setting may undermine students' feeling of community. Therefore, it is crucial to cultivate students' sense of community in their online classrooms to enhance student-student interaction (Conrad, 2005; Oh et al., 2023; Zembylas, 2008). In MOOC BL settings, learners exclusively engage in communication and interaction with others who possess a direct connection to them in the context of discussion forums (Castellanos-Reyes, 2021; Ucha, 2023). In addition, the level of engagement amongst learners was rather low due to their preference for engaging in face-to-face communication with their peers. Additionally, learners exhibited a preference for engaging in communication with peers who attended the same university (Jitpaisarnwattana et al., 2021). To enhance learner-learner interaction, group projects and challenging classroom activities should be employed to foster collaboration and engagement among learners (Mijatovic et al., 2012; Shafaat et al., 2014).

Student-Instructor Interaction

Student-instructor interaction refers to the interaction between the learner and the knowledgeable individual who developed or delivered the subject content, playing roles as teachers or facilitators (Moore, 1989). In the context of student-instructor interaction, the instructor's purpose is to actively engage and maintain the student's interest in the subject matter being taught to help students acquire knowledge and skills, which includes promoting self-directed learning and self-motivation. To improve the level of interaction between learners and instructors in the virtual learning environment, it is recommended that teachers post questions and answers in a discussion forum as well as instant feedback (Elson et al., 2018). Besides, challenging tasks can enhance student collaboration to fulfill a learning objective (Mijatovic et al., 2012). The absence of interaction between students and their instructors in online discussion forums or through direct feedback leads to a negative perception of MOOCs. Therefore, there is a need to prioritize the improvement of meaningful interaction in MOOC design, as learners require regular support from their instructors (Liu et al., 2020; Ucha, 2023). MOOC course designers are urged to enhance the direct connection between learners and instructors, as this has an impact on the intention of MOOC learners to continue using MOOCs (Alemayehu & Chen, 2023; Gregori et al., 2018; Kim et al., 2021).

Student-Content Interaction

Student-content interaction was defined as "the process of intellectually interacting with content that results in changes in the learner's understanding, the learner's perspective, or the cognitive structures of the learner's mind" (p. 2) (Moore, 1989). The interaction between learners and the content in the BL environment involves finding information, reading information texts, watching videos, pausing, stopping or replaying the videos, taking notes and completing quizzes and assignments (Baturay, 2015; Liu et al., 2020; Mohamed & Hammond, 2018). The material design in MOOCs is crucial in shaping learners' intentions for future learning (Cho et al., 2024). Therefore, it is important to examine design methods that promote effective interaction between learners and the content (Kim et al., 2021; Wei & Taecharungroj, 2022). Besides, the quality of content can contribute to the level of student satisfaction in BL since it fosters student motivation in the exploration of the new course content (Du, 2023; Gameel, 2017; Kuo et al., 2014).

Student-Technology Interaction

Interaction refers to the process in which learners use technological tools and devices to gain knowledge and skills through their senses (Hillman et al., 1994). In blended courses, learners interact with the learning tools or platforms to navigate their learning tasks, such as learning management systems (LMS) and MOOCs platforms (Pursel et al., 2016). Moreover, students interact with other students through interactive tools, built-in discussion forums, or live quizzes (Garg et al., 2023). They also give feedback to other students by sending review forms or suggestions in discussion forums (Wei et al., 2023). Interactive activities can also be conducted through MOOC video lectures with embedded questions (Deng & Gao, 2023). Hence, the interaction between learners and technology in MOOCs plays a crucial role in the learning process (Wang & Zhu, 2019).

Table 1. Detailed demographics of the participants

	Items	Frequency (n = 339)	Percentage (%)
Gender	Male	217	64.0
	Female	122	36.0
Major	English	57	16.8
	Information technology	66	19.5
	Business	58	17.1
	Multimedia communication	57	16.8
	Japanese	47	13.9
	Korean	24	7.1
	Chinese	30	8.8
Study year	First	227	67.0
	Second	97	28.6
	Third	15	4.4

METHODOLOGY

Research Design

A mixed-method data collection approach was employed to explore student interaction in bMOOCs. In this study, both qualitative and quantitative data were collected concurrently and then analyzed together to provide a more comprehensive understanding of the research problem (Creswell, 1999; Creswell & Plano Clark, 2007). Besides, the approach was commonly utilized when the researcher would like to collect and analyze the quantitative and qualitative data that are concurrent but separate (Morse, 1991). Therefore, the mix-method data collection approach was suitable for the study to investigate student interaction in bMOOCs through both quantitative data (the questionnaire) and qualitative data (interviews).

Participants

A convenience sampling technique was used to select participants for the study. The t-test from G*Power software (version 3.1) was used to measure the total sample size (one sample group, a two-tailed test, d = .3, α = .05, and 1 – β = .95). The result confirmed that the total sample size should be at least 134. Therefore, the study's total population of 339 students (64% males and 36% females) from different majors at a private university in Vietnam was satisfactory. Their ages ranged from 18 to 22. Besides, ten students were randomly selected to participate in a semi-structured interview. The detailed demographics of the participants are presented in **Table 1**. The participants were volunteers in the data collection procedures, and the ethical clearance was approved by the Department Head of the university. Written informed consent to participate and publish the study was obtained from all of the participants before the data collection process to ensure the anonymity of the participants.

Research Instruments

A mixed-method data collection approach was employed to answer the RQs. To collect quantitative data, the questionnaire items were adopted and modified from the literature (Kuo et al., 2014; Yousef et al., 2015). There were 35 items in the questionnaire categorized into five domains: learner-learner interaction (10 items), learner-instructor interaction (10 items), learner-content interaction (6 items), learner-technology interaction (4 items), and learner satisfaction (5 items). The questionnaire was designed based on a 5-point Likert scale, coding 1 = "very low" to 5 = "very high". To collect qualitative data, 10 participants out of 339 were involved in semi-structured interviews with open-ended questions regarding five domains of interaction and satisfaction in BL using Coursera MOOCs (see **Appendix A**). The content validity was established through a peer-reviewed evaluation of the appropriateness and comprehensibility of the language used in the questionnaire items. The reliability of the questionnaire was assessed using the statistical package for the social sciences (SPSS) software version 25. The Cronbach's alpha value of interaction types was higher than .7, indicating the reliability of the questionnaire, which is described in **Table 2**.

Table 2. The reliability result of the questionnaire

	Cronbach's alpha value
Student-student interaction	.72
Student-instructor interaction	.76
Student-content interaction	.71
Student-technology interaction	.70

Table 3. Students' perception of interaction types in bMOOCs (N = 339)

	M	SD
Student-student interaction	3.71	.37
Student-instructor interaction	3.80	.36
Student-content interaction	3.73	.40
Student-technology interaction	3.79	.47
Interaction	3.76	.35

Table 4. One-sample t-test statistics of students' interaction (test value = 3.0)

	t	df	Sig. (2-tailed)	Mean difference	95% confidence interval of the difference	
					Lower	Upper
Mean	39.66	338	.00	.76	.72	.80

Table 5. Means of student-student interaction in bMOOCs (N = 339)

	M	SD
I had a lot of interaction with other students in my online class sessions on Coursera.	3.57	.66
I had a lot of interaction with other students in my offline class sessions.	3.79	.72
I got a lot of feedback from other students through online discussion forums on Coursera.	3.53	.66
I got a lot of feedback from other students in my offline class sessions.	3.85	.68
I interacted directly with other students.	3.79	.75
I answered other students' questions through the online discussion forums on Coursera.	3.64	.71
I shared my thoughts or ideas with other students during my offline class sessions.	3.89	.63
I commented on and graded other students' ideas and assignments.	3.69	.72
Group activities in offline class sessions gave me more chances to interact with other students.	3.84	.67
Peer-reviewed assignments gave me more chances to interact with other students.	3.55	.75

RESULTS

RQ1: To What Extent Do Students Perceive the Level of Interaction in BMOOCs?

A descriptive statistics test and a one-sample t-test were computed by SPSS (version 25) to measure the extent students perceived the level of interaction in BL using MOOCs.

As can be seen from **Table 3**, the level of interaction perceived by students in BL using MOOCs was relatively high (mean [M] = 3.76, standard deviation [SD] = .35). The results from the one sample t-test (**Table 4**) indicate that the mean score was significantly different from the neutral level of 3.0 (t = 39.66, df = 338, p = .00).

Specifically, the level of interaction between students and instructors was most perceived at a high level (M = 3.80, SD = .36). The level of interaction between students and the technology students used in BL on the platform Coursera was also considerable (M = 3.79, SD = .47). Learner-learner and learner-content interaction were perceived at a positive level (M = 3.71 and M = 3.73, SD = .37 and SD = .40).

Student-student interaction

The results from **Table 5** reveal that the interaction level between students and other students in BL using MOOCs ranged from 3.55 to 3.89, indicating that learner-learner interaction was perceived at a relatively high level. The interaction between students and other students in offline classes (M = 3.79, SD = .72) was higher than the interaction in online class sessions (M = 3.57, SD = .66). When getting feedback from other peers, students still preferred interacting with their classmates in their offline classes (M = 3.85, SD = .68). Moreover, the level of direct interaction with other students was also recorded with a high mean score (M = 3.79, SD = .75). Students interacted more with their peers by sharing ideas or answering friends' questions in offline class

Table 6. Means of student-instructor interaction in bMOOCs (N = 339)

	M	SD
I had a lot of interaction with my instructors in my online class sessions on Coursera.	3.70	.70
I had a lot of interaction with my instructors in my offline class sessions on Coursera.	3.82	.67
I asked the instructors my questions through the online discussion forums.	3.61	.61
I asked the instructors my questions in offline class sessions.	3.92	.64
The online instructors replied to my questions promptly.	3.65	.63
The offline instructors replied to my questions promptly.	3.96	.66
I replied to the questions from the online instructors.	3.72	.59
I replied to the questions from the offline instructors.	3.88	.66
I received enough feedback from my online instructors.	3.68	.64
I received enough feedback from my offline instructors.	4.02	.62

Table 7. Means of student-content interaction in bMOOCs (N = 339)

	M	SD
I better understood the course content through the online course materials.	3.60	.63
Online course materials aroused my interest in taking the course.	3.67	.70
Online course materials helped me achieve the course objectives.	3.61	.61
I spent a lot of time reading and watching online lecture videos.	4.11	.64
I looked at other online resources as a supplement to the course materials.	3.58	.61
It was easy for me to access the online course materials.	3.83	.60

sessions (M = 3.89, SD = .63) as they also thought that group activities in offline classes improved their interaction with other classmates (M = 3.84, SD = .67). Additionally, when students commented on and graded other peers in their assignments, it was also a chance for them to interact with their friends (M = 3.69 and M = 3.55, SD = .72 and SD = .75). In general, students perceived their interaction with other friends in offline classes rather than online ones.

Student-instructor interaction

As in **Table 6**, the results indicated that the interaction between students and their instructors was recorded at a quite high level, ranging from 3.61 to 4.02. Students admitted that they interacted more with their teachers in offline classes (M = 3.82, SD = .67) than in offline ones (M = 3.70, SD = .70). When students had questions, they preferred asking their teachers in offline sessions (M = 3.92, SD = .64) to offline ones (M = 3.61, SD = .61). In offline classes, students supported that their teachers replied to their questions faster than in online class sessions (M = 3.96, SD = .66). Similarly, when students answered their teachers' questions, they inclined to their offline teachers (M = 3.88, SD = .66). Especially, offline teachers gave students more adequate feedback (M = 4.02, SD = .62) than online teachers (M = 3.68, SD = .64). In general, the level of interaction between students and offline teachers was slightly higher than that of online instructors.

Student-content interaction

As can be seen from **Table 7**, students interacted with the content in BL using MOOCs at a positive level. The most noticeable activity was when students spent a lot of time reading the materials available on MOOCs and watching online lecture videos (M = 4.11, SD = .64). They found it easy to get access to the available course materials (M = 3.83, SD = .60). Besides, students indicated that they felt interested in their courses thanks to the online course materials (M = 3.67, SD = .70) as the online course materials helped them achieve the objectives (M = 3.61, SD = .61). In addition, students also looked at the supplement (M = 3.58, SD = .61) and understood the content of the courses they took (M = 3.60, SD = .63). In conclusion, students' interaction with the content was perceived positively, especially when the time students spent most was reading and watching online video lessons.

Student-technology interaction

Table 8 reveals that students interacted with the technology used in BL at a positive level. Specifically, students seriously tracked their assignment grades and status on the platform of Coursera (M = 3.89 and M = 3.96, SD = .64 and SD = .63). Besides, they also used technology as a means to communicate and interact

Table 8. Means of student-technology interaction in bMOOCs (N = 339)

	M	SD
The technology improved my communication with other students and instructors.	3.60	.63
I found it easy to interact with other students and instructors through technology.	3.70	.69
I could track my assignment status easily.	3.96	.63
I could track my grade status easily.	3.89	.64

Table 9. Means of students' satisfaction with interaction types in bMOOCs (N = 339)

	M	SD
I was satisfied with bMOOCs.	3.73	.67
Blended learning using MOOCs was a useful learning experience for me.	3.70	.63
Blended learning using MOOCs improved my learning interaction.	3.55	.67
I was satisfied with the level of interaction in bMOOCs.	3.64	.64
I will continue to take a bMOOC in the future.	3.88	.67

Table 10. Pearson correlations between students' interaction types and satisfaction in bMOOCs

		SS	SI	SC	ST	SA	I
Student-student interaction (SS)	Pearson correlation	1	.74**	.72**	.65**	.71**	.91**
	Sig. (2-tailed)		.00	.00	. .00	.00	.00
Student-instructor interaction (SI)	Pearson correlation	.74**	1	.72**	.66**	.70**	.91**
	Sig. (2-tailed)	.00		.00	.00	.00	.00
Student-content interaction (SC)	Pearson correlation	.72**	.72**	1	.67**	.65**	.86**
	Sig. (2-tailed)	.00	.00		.00	.00	.00
Student-technology interaction (ST)	Pearson correlation	.65**	.66**	.67**	1	.67**	.81**
	Sig. (2-tailed)	.00	.00	.00		.00	.00
Satisfaction (SA)	Pearson correlation	.71**	.70**	.65**	.67**	1	.78**
	Sig. (2-tailed)	.00	.00	.00	.00		.00
Interaction (I)	Pearson correlation	.91**	.91**	.86**	.81**	.78**	1
	Sig. (2-tailed)	.00	.00	.00	.00	.00	

** Correlation is significant at the 0.01 level (2-tailed)

with their peers and teachers (M = 3.60 and M = 3.70, SD = .63 and SD = .69). In general, the level of interaction between students and technology was relatively high.

Student satisfaction with bMOOCs

The results from **Table 9** indicate that students felt quite satisfied with the interaction types in BL using MOOCs (M = 3.64, SD = .64), so they supported that they would continue to use MOOCs in their blended classes (M = 3.88, SD = .67). Besides, students also expressed their satisfaction with BL using Coursera MOOCs (M = 3.73, SD = .67) as they believed that using MOOCs in their blended classes could improve their interaction (M = 3.55, SD = .67).

RQ2: What Is the Correlation Between Students' Satisfaction and the Level of Interaction in BMOOCs?

The results from **Table 10** depict that there was a positive relationship between students' interaction types and their satisfaction with bMOOCs (r = .78, p = .00). The most remarkable relationship was between students' satisfaction and learner-learner interaction (r = .71, p = .00). Learner-instructor interaction was also highly correlated to students' satisfaction in bMOOCs (r = .70, p = .00). The correlations between students' satisfaction and learner-technology and learner-content interaction were also positive (r = .67 and r = .65; p = .00). Besides, positive correlations were found among the types of interaction in blended Coursera MOOCs. Specifically, the strongest correlation was between learner-learner and learner-instructor interaction (r = .74, p = .00). Moreover, to enhance the level of interaction in bMOOCs, it would be essential to increase learner-learner and learner-instructor interaction as their correlations to interaction was significantly positive (r = .91, p = .00). In general, students' satisfaction would be increased once their interaction types were improved.

Table 11. Summary of challenges and suggestions for improving learners' interaction in bMOOCs

Theme	Challenges	Count	Suggestions	Count
Student-student interaction	Lack of community building and collaborative learning	6	Using online discussion forums to facilitate peer-to-peer interaction, debates, and knowledge sharing; using games and virtual networking events; encouraging learners to collaborate on group projects or assignments	5
Student-instructor interaction	Limited face-to-face interaction and personalized feedback	8	Encouraging instructors to maintain a strong presence in both online and offline classes; providing instant feedback on assignments to each student via emails	7
Student-content interaction	Quality of online content, mismatch between MOOC content and specified course syllabus	5	Evaluating MOOC materials and sources; selecting suitable MOOCs that match the course objectives and meet learning outcomes	8
Student-technology interaction	Technical difficulties, lack of training and support	5	Upgrading a user-friendly learning platform with interactive features; providing comprehensive support, tutorials, resources to help troubleshoot issues and use technology effectively	5

RQ3: What Are the Challenges in Student Interaction and Suggestions to Enhance Their Interaction in BMOOCs?

The interviews were conducted through open-ended questions to explore students' interaction challenges and suggestions for improving their interaction in the bMOOC learning environment. Ten participants shared their thoughts about their problems when they took bMOOCs. The interview questions were categorized into four main themes: learner-learner interaction, learner-instructor interaction, learner-content interaction, and learner-technology interaction. The answers were coded and analyzed for the similarities and commonalities of each theme. The summary of challenges and suggestions is presented in **Table 11**.

Student-student interaction

Many students reported that there was a lack of community building in a blended class with MOOCs. In other words, students could have a sense of community and belonging as students found it difficult to interact and collaborate with other peers to complete a learning task. Therefore, they might feel less motivated to engage in learning activities in both online and offline classes.

> "It is not easy for me to interact with other students in MOOCs because I don't know exactly who they are. I only interact with my classmates in offline classes, so I think bMOOCs don't give me a sense of community building. I want to communicate with my peers, but it seems like I can't due to limited access to contact. In short, I think it's hard to build a learning community without frequent communication and interaction with other students" (interview extract 4).

> "My interaction with other students is limited because there are only individual tasks and assignments in MOOCs. In offline classes, my teachers gave me a few group work tasks, so I sometimes interacted and worked together with them. I think collaborative learning in bMOOCs is not strong and sufficient to motivate me to interact with my classmates to complete a task" (interview extract 9).

To enhance the interaction among learners in bMOOCs, students suggested that using online discussion forums could help facilitate peer-to-peer interaction, debates, and knowledge sharing. Icebreaking activities using games in offline classes and virtual networking events in MOOCs could foster student engagement and interaction. Besides, it would be more interactive if teachers encouraged learners to collaborate on group projects or assignments.

> "When I want to ask a question, I think it's great to post it in a discussion forum because my friends can read it and help me with an answer, or they can raise an issue to debate about a topic MOOC

> instructors gave in a course. It's also a good place to share knowledge and interact more with other peers" (interview extract 2).
>
> "I usually interact with my classmates when we do projects or assignments together, so teachers can encourage student collaboration by doing these tasks in groups. I think they will interact more with their peers to complete these given tasks" (interview extract 4).

Student-instructor interaction

Many of the participants claimed that their interactions with their MOOC instructors and offline mentors were limited. They reported that it was not possible to have a face-to-face conversation or discussion with their MOOC instructors, so students could not receive instant feedback. In offline classes, students could meet their mentors or teachers face-to-face, but the time spent in offline classes was limited. Moreover, students thought that personalized feedback for assignments was insufficient due to the limited time frame. They believed that detailed feedback from their MOOC instructors and offline mentors could come to each of them so that they could figure out their mistakes and gain knowledge.

> "Honestly, I just watch video lectures and do assignments in MOOCs, so my face-to-face interaction with my MOOC instructors is limited. I only meet my offline mentors in my class, but we have a class every two weeks. I think it is not enough for us to discuss or ask questions. This lack of face-to-face interaction with my instructors and mentors might discourage me from my learning" (interview extract 5).
>
> "When I have questions about my assignments, I just post them in the discussion forums, but I rarely receive responses from my instructors. My offline mentors usually help me to solve my problems and give me feedback. However, my offline mentors often give general feedback for group assignments or projects, so for individual tasks, I think personalized feedback is better so that I know what my mistakes are, and I can revise my assignments for better products" (interview extract 3).

Students suggested that instructors should be encouraged to maintain a strong presence in both online and offline classes so that students could meet and ask for assistance when they had difficulties in their studies. Besides, students expected instructors to provide instant feedback on participation, contributions, and assignments for both group work and individual tasks.

> "I think it is good if my MOOC instructors and offline mentors keep their strong presence during my course because I can ask them when I do not know something about my lessons. You know, sometimes I'm stuck but I cannot connect and interact with my instructors directly. I feel like I'm failing my course when my problem is not solved without the presence of my instructors" (interview extract 1).
>
> "Sometimes I make mistakes or get low grades for my assignments, but I do not know where I'm wrong. My instructors do not usually provide us with instant feedback, so I do not know how to improve my assignments next time. I hope that my instructors can give me instant feedback by email or comments on what I should pay attention to" (interview extract 1).

Student-content interaction

When students interact with the content in bMOOCs, they raise concerns about the quality of the MOOC content. They were afraid that the online sources and materials provided by MOOCs were not very reliable once many courses were offered by many universities and whether the content was evaluated by a board of experts in the field. Moreover, students found that some content was not relevant to the description of the course in their institutional syllabus. This mismatch would make it hard to achieve the course learning outcomes

> "When watching MOOC video lectures, I see some content is really easy, but some is difficult to understand before it is much higher than what the course requires, I am not sure if the MOOC content is carefully reviewed and evaluated before a MOOC is chosen to integrate into a blended class. I think the quality of MOOC content is sometimes questionable" (interview extract 5).

> "Some parts of a MOOC do not match the course objectives described in the syllabus issued by my university, but I do not know why they chose it. Students will feel bored if they take this MOOC" (interview extract 8).

The participants claimed that the MOOC content should be evaluated by a panel of experts before choosing it. Curriculum developers should be responsible for choosing a suitable MOOC to incorporate into a blended course.

> "After a course, I think my university should take opinions from students to evaluate if a chosen MOOC is suitable. Then, experts and administrators should sit together to discuss and make decisions to replace it with another suitable MOOC" (interview extract 1).

> "If we continue to take an unsuitable MOOC, it would be a nightmare as we cannot gain knowledge. The curriculum experts should check those unsuitable MOOCs claimed by students to make a change to meet the learning outcomes of the institutional course" (interview extract 3).

Student-technology interaction

Students reported that they often experienced technical difficulties such as logging into their accounts, streaming video lectures, and submitting their assignments when they took bMOOCs on the Coursera platform. Although they received a manual guidebook about how to use the MOOC platform before each course, students still found it difficult to solve technical issues by themselves. They claimed that training and support from their institutions and MOOC providers were not sufficient.

> "Before a MOOC, my university gave us a guidebook to instruct how to use the Coursera MOOC platform. However, sometimes I cannot log into my account as announced with the wrong user and password. One time, I contacted my university for help, but I had to wait for a long time for them to give me a new account" (interview extract 6).

> "I remember once I submitted my assignments, but I chose the wrong file, so I wanted to edit my submission, but I failed because I received a red flag of plagiarism for that submission. I panicked and contacted my university and Coursera MOOC provider for help. I think many students have experienced the same technical difficulties especially when they first use MOOCs" (interview extract 4).

> "My bad experience with MOOC videos is when I was streaming video lectures to study, but I could not play the videos. I asked my teachers and university staff to help me. The reason for that was that my web browsers did not support Flash videos, so I could not play them. If they had training about how to watch MOOC videos, I would not have such a bad experience" (interview extract 8).

To improve user learning experience when using bMOOCs, students thought that they should be trained and supported by their institutions and MOOC providers by providing them with more comprehensive support, tutorials, resources, and interactive features. Besides, Coursera MOOC provider should upgrade their platform for a better user-friendly learning tool as they can use any device to take a bMOOC.

> "I need a training session about how to use the Coursera MOOC platform effectively before my course. For example, when I have any difficulties logging or submitting my assignments, I will know how to troubleshoot these technical issues. At least, a tutorial offered by Coursera can help me use the platform better" (interview extract 7).

> "I don't usually use my laptop to study with MOOCs, but other devices such as phones or tablets are sometimes incompatible with the MOOC platform. For example, when I play a video, it jumps into a new window, so I cannot watch the video and do a quiz at the same time. I hope that Coursera can upgrade its interactive features to make it easier and more user-friendly so that I can study anywhere anytime with any device" (interview extract 2).

DISCUSSION

The theory of interaction by Moore (1989) and Hillman et al. (1994) is fundamental in understanding interaction in online learning, especially in the bMOOC learning environment. Based on the theory of interaction (Hillman et al., 1994; Moore, 1989), four types of interaction: student-student interaction, student-instructor interaction, student-content interaction and student-technology interaction are discussed accordingly to investigate the level of student interaction, as well as their satisfaction, challenges they faced and suggestions for enhancing student interaction in bMOOCs.

The findings from **RQ1** show that students' interaction level in bMOOCs was perceived at a relatively high level (M = 3.76), as students expressed their favorable perception of bMOOCs regarding their higher level of interaction (Wu & Luo, 2022). Specifically, the student level of interaction with other peers was quite positive in BL using MOOCs. Students reported that they had more interaction with other students in offline sessions than in online ones since they preferred to meet their friends in offline classes (Fesol & Salam, 2016). Besides, they could receive more feedback from their classmates when they met in person to share their thoughts and ideas about their lessons. They thought that offline class sessions gave them more chances to interact with other peers in group activities rather than in MOOC sessions since they could interact directly with their peers to complete a learning task or project more effectively. This finding is consistent with the study by Wu and Luo (2022).

Regarding student interaction with their MOOC instructors and offline mentors, the finding depicts that they interacted more with their offline mentors in offline class sessions. Students found it more convenient to ask their offline mentors questions and receive feedback from them faster than asking their MOOC instructors in discussion forums, which was also confirmed by the study by Fesol and Salam (2016).

Student interaction with the content was positive as they interacted with the video content more than other sources of materials and supplements. The finding reveals that they spent plenty of time reading and enjoying watching MOOC lecture videos, which aligned with the previous study by Wu and Luo (2022). They also found it easy to access the course materials and resources because these online materials could help them achieve the course objectives. Besides, their reference to online resources could also arouse their interest in taking a MOOC.

When students interacted with MOOC technology, they felt that they could track their assignments and receive grades easily. The participants also stated that technology helped them interact with other peers and instructors through the MOOC platform under the discussion forums (Pursel et al., 2016).

The results from **RQ2** reveal that student interaction in bMOOCs had a strong correlation with their satisfaction with using Coursera MOOCs in their BL environment ($r = .78$, $p = .00$). The finding implies that the enhancement of student interaction in bMOOCs could make students more satisfied with the mode of MOOC-based BL. The finding is not in line with the study by Dai et al., in which the results showed that interaction quality was not related to learners' satisfaction (Dai et al., 2020). Besides, learner-learner and learner-instructor interactions had a strong relationship with student satisfaction with bMOOCs ($r = .70$ and $r = .71$, $p = .00$), which was inconsistent with the study indicating there was no correlation between those variables (Gameel, 2017). Meanwhile, learner-content interaction was positively correlated with learner satisfaction. The quality of content could motivate students to interact more with other peers and instructors and make them feel more satisfied with bMOOCs. The finding is in line with previous studies (Gameel, 2017; Kuo et al., 2014). In addition, the improvement of the interface could make the Coursera MOOC platform more interactive to encourage more interaction from students. In bMOOCs, the relationships among interaction types were also strong. Student-instructor and learner-learner interaction were also highly correlated ($r = .74$, $p = .00$). As students interacted more with their friends in MOOC-based blended classes, they were likely to interact more with their instructors.

For **RQ3**, the results from qualitative data indicated that students experienced some challenges when they were engaged in bMOOCs. A lack of community building and collaborative learning would prevent students from interacting with others. Although students engaged in offline classes with offline mentors, they still found it insufficient. They also suggested taking advantage of discussion forums in the Coursera MOOC platform to create more chances for students to interact with other peers and MOOC instructors as they had questions. In offline sessions, collaboration in group projects or challenging tasks should be enhanced to get more communication and involvement from peers since challenging activities could enhance student-student interaction (Mijatovic et al., 2012; Shafaat et al., 2014).

Regarding student interaction with their MOOC instructors and offline mentors, the findings implied that students still experienced limited face-to-face interaction with them. Moreover, the feedback they received was not personalized as they had lots of individual tasks (Yousef et al., 2015). Therefore, maintaining the presence of instructors was essential as students could get instant feedback or comments at least through various communication channels such as emails or discussion forums.

In addition, the findings show that students were concerned about the quality of the MOOC content as there were many similar courses available in the Coursera MOOC platform. Students also claimed that some content was not matched with the course objectives specified in the syllabus, which made students less satisfied with bMOOCs (Williams, 2024). To minimize the impact of these challenges, students suggested that a panel of experts and curriculum developers from their institution should evaluate and select a suitable MOOC to incorporate into their courses for the learning outcomes to be met.

Another finding related to student interaction with MOOC technology is that students experienced some technical issues such as logging, submitting, and plagiarism. These technical challenges emerged when integrating MOOCs into BL (Mellati & Khademi, 2020). They claimed that a lack of training and support before their courses was a point. Therefore, students expected to study with an upgraded MOOC platform with more interactive features along with tutorials and training from their institution or MOOC providers so that they could avoid those technical issues and study more productively, in which Williams (2024) confirmed the need for institutional support in bMOOCs in his study.

CONCLUSION

The study aims to explore student interaction, satisfaction, challenges, and suggestions to enhance their interaction in BL using Coursera MOOCs. The findings reveal that students' perceived level of interaction in bMOOCs was relatively high. Besides, their satisfaction with bMOOCs was also positive. Moreover, it is noticeable that there was a strong correlation between student interaction and their satisfaction with bMOOCs. Therefore, the enhancement of student interaction types regarding learner-learner interaction, learner-instructor interaction, learner-content interaction, and learner-technology interaction would make students more satisfied with BL using Coursera MOOCs. This finding suggests practical implications for MOOC instructors, offline mentors, and MOOC providers to increase student interaction to motivate them in their learning process. Besides, several challenges are raised, including limited face-to-face interaction and collaboration, lack of instant feedback, low quality of teaching content, technical issues, and institutional support. To minimize the negative impact of these challenges, possible suggestions for improvement are drawn regarding encouraging direct interaction between students and other peers or instructors, providing more prompt personalized feedback, selecting suitable and quality content, and supporting students with technical issues. The finding yields pedagogical implications for instructors to employ more effective methodologies to get students engaged and enhance their interaction in bMOOCs. Administrators, curriculum developers, and MOOC providers are supposed to upgrade the syllabi and the MOOC platform.

This study has several limitations. The first limitation is that the investigation is of one MOOC platform (Coursera) while there are several MOOC providers such as EdX, Udacity FutureLearn, Canvas Network, or Khan Academy. Therefore, the exploration of student interaction from various MOOC providers could create a universal view and comparison among MOOCs. Second, the study was conducted in one higher education institution in Vietnam from only students' perspectives. The involvement of different research locations, settings, and stakeholders would provide a clearer picture of using bMOOCs in higher education, so future research can take it into account.

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Data availability: Data generated or analyzed during this study are available from the author on request.

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APPENDIX A: SEMI-STRUCTURED INTERVIEW QUESTIONS

1. What are some challenges you face when interacting with other students in bMOOCs?
2. Can you suggest some good ways to enhance interaction between you and other students in bMOOCs?
3. What are some challenges you face when interacting with your instructors in bMOOCs?
4. Can you suggest good effective ways to enhance interaction between you and your instructors in bMOOCs?
5. What are some challenges you face when interacting with the content (e.g., materials and MOOC videos) in bMOOCs?
6. Can you suggest some good ways to enhance interaction between you and the content (e.g., materials and MOOC videos) in bMOOCs?
7. What are some challenges you face when interacting with technology in bMOOCs?
8. Can you suggest some good ways to enhance interaction between you and technology in bMOOCs?