

INSTRUCTORS' EPISTEMIC INTERVENTION STRATEGIES IN MOOC DISCUSSION FORUMS

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ABSTRACT

Facilitating students' learning in a massive open online context is challenging for instructors in online teaching. The instructors should enact their professional (epistemic) feedback-giving skills to understand when, how, and why to address learning problems. In this study, we address this issue in terms of agency and suggest strategies that teachers can use to address these problems constructively. This study examines how instructors' professional agency comes into play in selecting how to intervene to assist students in solving problems in course discussion forums (Facebook group and Canvas discussion forums), which we refer to as an epistemic intervention strategy (EIS). By analyzing discussion forums' dialogical posts using thematic analysis and epistemic network analysis, we found that instructors adopted five different EISs to address students' learning. The EISs emerged during the processes of facilitating students' learning and were influenced by the complexity of students' questions and positioning in learning in the discussion forums. The findings of this study can inform practitioners that facilitating learning in online discussion forums may demand that instructors go beyond their feedback-giving skills to enact professional agency.

Keywords: *professional agency, student agency, epistemic intervention strategy, zone of proximal development, MOOCs*

INTRODUCTION

This study examines how instructors enacted their professional feedback-giving skills, which we refer to as teachers' epistemic intervention strategies (EISs), to support students' learning in the Facebook group and Canvas discussion forums of an institutional massive open online course (MOOC) offered by a Norwegian university college aiming to develop students' (preservice and in-service teachers) professional digital competence. It also examines how instructors' EIS was affected by student agency in learning in the discussion forums. The first generation of MOOCs, also called connectivist MOOCs or cMOOCs, envisioned students working as autonomous actors who could build up and expand learning networks, with instructors being able to participate in the working

of these networks (Downes, 2012). Learning as a process of connecting, growing, and navigating resources occurs through the construction and traversing of the networks; thus, knowledge and cognition are distributed across networks (Siemens & Tittenberger, 2009). Therefore, the emphasis was given to promoting the principles of autonomy (contributions to interaction according to one's space, pace, means, and values), diversity (approaching the matter from multiple perspectives), openness (mechanisms allowing various views), and interactivity (connection and interaction between participants) for learning and creating knowledge together (Downes, 2012). However, empirical studies indicate that open landscapes of cMOOCs may challenge learners to find and engage in proper networks independently. Thus,

instructors' proper pedagogical support is required to promote students' learning in different spaces (e.g., discussion forums) (Bozkurt & Keefer, 2018; Downes, 2019).

The second generation of MOOCs, also called xMOOCs, emphasizes offering fine-tuned quality content for learning independently (Bates, 2020). However, the distinction between cMOOCs and xMOOCs remains blurry as current versions of MOOCs tend to take a hybrid form (Bayne & Ross, 2014), and different types of MOOCs are emerging in different national and international contexts (Liyaganawardena et al., 2019). Principles of original cMOOCs may also be promoted in xMOOCs because they emphasize connection, discourse, and collaboration among participants, mainly through discussion forums. Although the Pedagogical Information and Communication Technology Massive Open Online Course (ICTPED MOOC), the object of this study, is like an xMOOC, it encourages participants' active engagement in sharing ideas and interacting with fellow participants and instructors through synchronous (e.g., Teams and Zoom) and asynchronous (e.g., discussion forums) means. Research studies have consistently documented that one of the reasons students drop out of MOOCs is the lack of instructor presence and engagement in facilitating students' learning (Aldowah et al., 2020; Kotzee & Palermos, 2021). This study examines various intervention strategies instructors used to support students' learning in discussion forums of the ICTPED MOOC, which may have consequences for collaborative learning and students' retention in online courses (Kotzee & Palermos, 2021).

Course discussion forums are one of the primary tools and spaces for communicating and exchanging ideas and social learning in MOOCs (Aldowah et al., 2020; Almatrafi & Johri, 2019). Communication and the exchange of ideas in these forums create an interactive learning environment, which aims for the development of a zone of proximal development (ZPD) (Vygotsky, 2012). ZPD is a sociopedagogical space that allows instructors or more knowledgeable participants to know, clarify, and assess students' knowledge claims or actual understanding of learning content or problems and to conceive possible interventions to address the lack of knowledge (Kostogriz & Veresov, 2021). Facebook group and Canvas discussion forums can nurture what Derry (2013) calls the "space

of reasons" (p. 230), which is developed in and through collaborative teaching and learning activities. However, the mere availability of forums does not ensure learning (Parks Stamm et al., 2017), and discussion forums should be nurtured as "spaces of reasons." This can be accomplished when teachers think strategically about when, how, and why to intervene in students' learning activities, as too little or excessive interventions may discourage students engaging in learning (Palloff & Pratt, 2011). Teachers need to enact their epistemic agency—the capacity to make principled choices in taking actions to address students' learning by participating in collective discourse (MacLellan, 2017). Furthermore, the ways instructors intervene to encourage learning in MOOC discussion forums may influence student agency—the capacity to learn how to engage meaningfully in learning to develop and advance conceptual understanding (Engeness, 2021). Thus, we conceptualize instructors' EISs as the enactment of instructors' professional knowledge, which is defined as the capacity to make pedagogical choices in deciding when, why, and how to intervene in students' learning in MOOC discussion forums, which we report in this study. From the cultural-historical theory perspective, which we adopted for this study, knowledge is not information to be stored and retrieved but a set of activities to be developed, enacted, and re-enacted while solving problems in the shared space (Arievitch, 2020). Higher-order thinking develops in the spaces of engagement, but MOOCs often fail to promote student engagement, interaction, and collaborative learning (Margaryan et al., 2015). We address these challenges by identifying and illuminating the relative importance of intervention strategies that instructors use to address students' learning problems in MOOC discussion forums.

LITERATURE REVIEW

The debate concerning when and how instructors should intervene in students' learning processes still looms in traditional and online learning environments. Scholars recognized the importance of instructor intervention in online learning long before the MOOC era (Chiu & Hew, 2018; Garrison, 2017). When it comes to fostering constructive learning in online education, previous studies offer conflicting and inconclusive findings.

For example, instructors' excessive interventions, such as correcting every question, might discourage student engagement and participation in online learning environments (Andresen, 2009; Palloff & Pratt, 2011). The more instructors post in the discussion forums, the shorter the length of the discussion becomes (Dixson et al., 2006; Mazzolini & Maddison, 2003), but lengthy discussions might foster deep learning (Mazzolini & Maddison, 2003). Thus, student engagement (Martin & Bolliger, 2018) and teachers' strategic facilitation (Martin et al., 2020) matter for more productive learning in discussion forums. Engagement as a key driver for learning (Deng et al., 2020) is promoted when active learning and peer interaction are supported by course instructors (Hew, 2016; Martin et al., 2020). Engaging with peers and instructors fosters meaning-making activities in MOOC discussion forums (Hew, 2016; Shea et al., 2022). Instructors need to have in-depth professional knowledge and enthusiasm to monitor students learning activities and mobilize resources to facilitate students in discussion forums (Hew, 2016; Martin et al., 2020).

Martin et al. (2020) conducted a qualitative (interview) study with eight award-winning faculty members in the United States and outlined five different roles for online teaching: facilitator, course designer, content manager, subject matter expert, and mentor. Their common task was course design and teaching. They found the facilitator's role was the most important one, which includes pedagogical tasks of welcoming students, helping students feel comfortable and managing time, being responsive to students' queries or needs, providing feedback, and promoting interaction and engagement. Therefore, recent studies suggest including both synchronous and asynchronous approaches to facilitate students' learning in online environments (Martin et al., 2023).

In conventional MOOCs (i.e., the xMOOCs offered by big platforms such as FutureLearn, Coursera, and edX), instructors, especially teaching assistants (TAs), are the main actors in supporting students' learning in MOOC discussion forums by keeping track of their learning activities and intervening to address learning problems (Ntourmas et al., 2019; Singh & Mørch, 2018). However, Ntourmas and colleagues found that some TAs lacked knowledge about how to address

students' learning needs and promote interaction and collaboration among them. Their study raised questions about the capacity of TAs to address these needs and promote collective knowledge-building in MOOC discussion forums. For instructors, discussion forums remain a vital tool for monitoring students' learning activities and devising strategies for further interventions (Jiang et al., 2015). For students, discussion forums are spaces for offering and receiving help in their learning (Breslow et al., 2013). Those who engage in peer interaction are more likely to complete the course than those who do not (Sunar et al., 2016), and those who never receive responses in discussion forums are more likely to drop the courses than those who do (Schaffer et al., 2016). Therefore, several studies indicate the importance of integrating social media such as Facebook into MOOCs, as they might augment the exchange of ideas, interaction, personal learning, network-building, student motivation, and retention (Chen & Chen, 2022; Ripiye et al., 2017). Lack of social interaction leads to feelings of isolation, resulting in disengagement and dropping out (Badali et al., 2022). Interaction and dialogue, which MOOCs often fail to promote, are required to enact and enhance human agency in learning (Harasim, 2017). Individual learners grow from interaction with fellow learners, improving their social and cognitive learning abilities (Galikyan et al., 2021).

Social (engaging collectively with others) and cognitive (meaning-making) activities are interdependent. Empirical studies drawing on the community of inquiry framework (Garrison, 2017) have consistently demonstrated that establishing and sustaining social presence in MOOC discussion forums foster students' meaning-making and knowledge construction efforts (Shea et al., 2022). For example, feedback or comments that instructors or fellow students provide on students' postings are the most important factors affecting participation and persistence in online courses (Aldowah et al., 2020; Giacumo & Savenye, 2020). Instructors' prompts, such as icebreakers, including introductory posts (e.g., seed questions), hands-on exercises, and self-test assignments, and triggered discussions, including ambiguous questions, might promote student participation and collaborative learning in MOOCs (Giacumo & Savenye, 2020). Instructors and students consider

instructors' participation in discussion forums to be an essential factor contributing to quality online learning (Hew, 2015). Thus, teacher presence and feedback positively affect engagement and discussion in discussion forums. More engaged students learn more effectively, develop critical thinking, and demonstrate improved learning outcomes (Dyment et al., 2020).

Findings from previous research studies on ICTPED MOOC (and our research object) show that students mainly engage in learning through textual information and audio-video materials in the course (Engeness & Nohr, 2020; Engeness et al., 2020). By engaging with video tutorials, students learn how to engage in learning resources and use them to solve their learning problems, creating the possibility for fostering student' agency (i.e., the capacity to know how to engage meaningfully with learning resources) (Engeness et al., 2020). These studies point out the need for further research on how the actual facilitating and learning processes take place in online learning environments.

Beer (2019) observed that students' activities of listening and watching audio-video resources and posting questions and comments on MOOC discussion forums contributed to reflective and interactive activities, leading to transformative learning development. However, such activities remained at the lower levels (e.g., posting and commenting) of Mezirow's seven stages of critical reflection. The higher levels of transformative learning, according to Mezirow (2003), such as challenging perspectives, critical reflections, and discourses, rarely existed in the discussion forums, which may demand instructors' engagement in supporting students' learning.

To summarize, the literature mentioned above clearly indicates the importance of teacher engagement in MOOC discussion forums for promoting participation and engagement in learning and reducing the number of student dropouts from the course. These studies overwhelmingly demonstrate that the instructors' presence in discussion forums promotes productive learning. They mainly focus on improving MOOC design to promote instructors' participation, but none of the studies effectively address the constantly evolving learning activities on discussion forums for students. Our study addresses this by examining how instructors enact their professional agency in addressing students'

learning problems. We address the gap in previous research by asking the following research questions:

RQ1: How did the instructors' professional agency come into play when selecting intervention strategies to support the students' learning?

QR2: How was the instructors' intervention affected by the students' agency in learning in discussion forums?

THEORETICAL FRAMEWORK

Zone of Proximal Development

Vygotsky argued that concept formation and conceptual change occur when "empirically rich but disorganized" everyday concepts meet systematically organized adult concepts or scientific concepts (Vygotsky, 2012, p. 1). The meeting between these two concepts refers to a collaborative teaching and learning situation where instructors engage in sense-making with students and assess students' ideas, questions, and comments, which results in scaffolding or pedagogical supports in developing and expanding students' conceptual understanding of learning content or problems. Vygotsky asserted that instruction should therefore be carried out in students' ZPD (Vygotsky, 2012).

We conceptualize the ZPD as a sociopedagogical space where collaborative teaching and learning activities take place and where learners and instructors are interconnected in "a holistic process of interaction, intellectual development, and upbringing" (Kostogriz & Veresov, 2021, Contextualizing the ZPD, para. 2). We also conceptualize ZPD as a diagnostic tool by which instructors assess students' learning activities and devise strategies to address their learning needs. The sociopedagogical space is created through three distinct and interrelated domains of practice: "the material-semiotic, the cultural-historical, and the lived" (Kostogriz, 2005; cited in Kostogriz & Veresov, 2021, Pedagogical implications of the ZPD for Teaching in Diverse Settings, para. 1). The first domain is the availability and arrangement of organized material-semiotic resources or historically produced signs, tools, and means for learning and development, such as various multimodal resources (texts, audios, videos, tutorials, or reference materials) in the MOOC. The second domain encompasses "cultural-historical practices that create social environments," that is, "an intellectual space" (Kostogriz & Veresov, 2021,

Pedagogical implications of the ZPD for Teaching in Diverse Settings, para. 1) for education and development where relational practices are formed using material-semiotic tools for accomplishing joint activities. The third domain is the space of lived experiences or an intersubjectivity space where instructors and learners engage in dialogical communication, meaning-making, and collaborative learning. In the third domain, a new meaning is produced when students and instructors engage in exchanging ideas. Therefore, from the cultural-historical perspective on teaching and learning, instructors and students learn from each other when they engage in problem-posing and problem-solving activities collectively (Stetsenko, 2017). Professional agency as the capacity to understand and explain how to solve problems systematically by positioning in epistemic practices is learned, enacted, and developed in and through practices (Edwards, 2015).

We argue that MOOC discussion forums may be developed as the shared space for intellectual development if students and instructors systematically engage in making sense of and clarifying ideas with the aim of solving problems. However, they should go beyond simply posting and commenting in discussion forums to enact agency in teaching and learning. The instructors should actively engage in making sense of students' questions, think carefully about the ways of addressing them, and make sure that students' questions are addressed properly. Such processes require instructors' epistemic agency to promote students' learning. Agency as the capacity to make principled choices in selecting appropriate intervention strategies by participating in discourse (MacLellan, 2017) is relevant in this case as instructors should work with students and draw on their resources as well as the resources distributed across systems (Edwards, 2015). Instructors' enactment of their epistemic agency can influence student agency—the capacity to meaningfully engage in learning activities (Engeness, 2021)—and vice versa, as agency as the capacity to engage meaningfully in learning activities is realized, enacted, developed, and expanded in and through collaborative teaching and learning practices (Stetsenko, 2017). The focus of collaborative interventions is to help students advance their understanding of existing (spontaneous) concepts by “demonstrations, leading questions, and by introducing the initial elements of the task's solutions” (Vygotsky, 1987, p. 209). In

online, credit-based courses, instructor interventions are usually required to clarify misunderstandings or misconceptions, to provide accurate feedback, to ensure that the criteria for academic learning—such as the use of evidence of claims, clarity of argument, and so on—are being met, and to ensure the necessary input and guidance so that students seek deeper understanding (Harasim, 2017).

METHODOLOGY

This study is primarily a qualitative research inquiry using nonparticipant observation and survey methods to examine how instructors adopt intervention strategies to support students' learning needs in an online learning context. Discussion forum exchanges are the primary data sources. The secondary data source is a postcourse survey designed to gain further insight into students' online learning experiences.

Setting and Participants

ICTPED MOOC is a credit-bearing course to develop digital competence among preservice and in-service teachers. The MOOC is an xMOOC; it consists of seven modules and includes video lectures, textual information texts, automated quizzes, and assignment tasks. The MOOC offered through the Canvas platform was in Norwegian and open to all Norwegian teachers (preservice and in-service). In the ICTPED MOOC, students had an opportunity to interact with the course instructors and their fellow students on Facebook group and in Canvas discussion forums and could also join online meetings with them. A total of 365 students signed up for the course, and 238 students completed it. The Facebook group contained 299 people, including six instructors and the Ammar Bahadur Singh as an observer. The number of participants varied in the discussion forums of each course module, but 78 students and six facilitators/instructors (two facilitators and four course instructors) engaged actively in the Canvas discussion forum of Module 3. One of the facilitators was engaged in handling technical issues for several in the same course, while another was a teaching assistant who had already completed the same course. Most of the discussions in the forums were about the examination assignment, and in Module 3 the students had to complete obligatory individual examination assignments. Therefore, the discussion forum of Module 3 was selected for the data analysis. On

average, 122 students responded to various questions in the postcourse survey. The primary data materials were the postings made by instructors and students in the Facebook group discussion and a Canvas discussion forum. The postcourse survey was the secondary data material.

Data Materials and Data Collection

The discussion forum data were collected using the method of nonparticipant observation (Mann & Stewart, 2000). Ammar Bahadur Singh was authorized to see, read, and use discussion forum data for research purposes. After the course was over, the students' discussion forum exchanges were carefully read and documented manually. Following the institutional guidelines for personal data protection, the data were anonymized in the documenting process. The anonymized survey data were obtained from the course administrator.

The survey questions consisted of two parts: the first part used a five-point Likert scale and in the second part students provided their comments. By analyzing the questions, we were interested in gaining further insights into students' perceptions and experiences of giving and receiving learning support from fellow students and course instructors or facilitators. The selected survey questions were integrated into different themes derived from the thematic analysis so they could provide further insight into the themes. The main survey questions selected for the analysis were:

1. To what extent were you satisfied with the feedback and guidance you received on the Facebook group and in the Canvas discussion forum?
2. To what degree have you been active in discussions in the Facebook group and the Canvas discussion forum?
3. To what degree were you satisfied with the guidance through video meetings?
4. From whom did you mainly seek help with your studies in the course?
5. How do you assess your experience of peer review assessment (only the pedagogical value, not the technical challenges)?
6. What is your assessment of the video feedback in the course?
7. How did you experience providing video feedback to fellow students?

DATA ANALYSIS

Thematic Analysis of Discussion Forum Data

The discussion forum data consisted of three types of data: thread posts without any discussions (information shared mainly by instructors), thread posts that invited discussion between instructors and students, and thread posts that invited discussion only between students. The thread posts inviting discussion between instructors and students and between students were considered dialogical exchanges, which aimed to solve various problems and contradictions related to course content. Each discussion thread contained a question or comments and replies from instructors and students, referring to the instructors' interventions in this study. Out of 218 posts, 194 were dialogical posts in the Facebook discussion forums, and all 79 posts in the Canvas discussion forum of a course module called Multimodal Text were dialogical. All dialogical posts were thematized. Significant activities that instructors and students carried out were also thematized during the process of thematic analysis. We conducted an inductive thematic analysis (Braun & Clarke, 2012, 2020) following the procedure shown in Table 1. The themes generated are shown in Table 2.

Table 1.
Process of Thematic Analysis

Steps	Activities
Gaining familiarity with the data	Reading, rereading, note-taking, and translating discussion threads Consulting with course instructors to understand some confusing posts
Generating themes	Listing discussion thread posts and coding them Giving a code to each discussion thread post and each discussion post that follows Combining thread post codes and discussion post codes
Searching for themes	Rereading the discussion lines and discussion threads to find new themes Comparing themes
Reviewing themes	Listing themes Combining or collapsing themes
Defining and naming themes	Naming, defining, and exemplifying themes Categorizing themes based on the modality of interventions and based on teamwork
Reporting themes	Developing a theme book

Epistemic Network Analysis

As a supplementary analytical method, we also conducted epistemic network analysis (ENA) to visualize the patterns of instructors' feedback-giving activities by measuring the numerated and the centrality values in the discussion forums, using the themes generated from thematic analysis and comparing the weighted values of relations of the themes for each instructor. ENA is based on the theory of epistemic frames (Shaffer, 2017), which stipulates that human activities are situated in communities of practice and involve knowledge-based (epistemic) conversation. Learning is embedded in these interactions, and thus learning is an interpersonal process where learners are engaged with peers or instructors. The themes generated through the thematic analysis were used to characterize the instructors' feedback-giving strategies (see Table 2). To the best of our knowledge, instructors did not devise intervention strategies in advance; they emerged while addressing students' learning needs in the discussion forums. We refer to them as the EISs that emerge from the combined thematic analysis and ENA. Following the national guidelines

for privacy protection, according to the General Data Protection Regulation, the instructors were informed that this study was being conducted. All instructors agreed to participate in this study by signing an informed consent form.

FINDINGS

Findings from Thematic Analysis

Using thematic analysis of dialogical postings in the discussion forum, we identified five major types of intervention strategies: (a) textual interventions, (b) video or textual-video tutorial interventions, (c) referral interventions, (d) remote interaction interventions, and (e) peer interventions. These strategies are defined and exemplified in Table 2.

Textual Intervention

The most common type of intervention was textual intervention. In both discussion forums, instructors and students were heavily engaged in replying to questions and writing comments. Textual inventions functioned as a catalyst for developing dialogue between instructors and students and between students and students.

Table 2.
Definitions of Themes

	Intervention strategies	Explanations	Examples
1	Textual intervention	Students post a question, and one instructor attempts to explain it in written comments.	S1: How can I show that I have copyright? T2: Show it in your reflection video.
2	Video intervention or Textual-video tutorial intervention	Instructors reply to students' questions with a self-made video that contains a much more elaborate explanation of a question or comment. Instructors answer students' questions in writing with a link to video tutorials that provide further information about the topic or question asked.	S35: How can the examiner open the file created in LearnLab? T1: Video reply to the question. S159: I could not import video clips into OneNote. T2: Find the menu on the top right side and click on import. You can see the video tutorial here also (link...).
3	Referral intervention	Instructors sometimes asked fellow instructors to answer students' questions by tagging them in the comments section.	S45: Video is not working in PowerPoint. T2: T6, will you please check it? T6: Will you please join the online video guidance meeting?
4	Remote interaction intervention	Instructors invite students to online guidance meetings as they think the problems need to be seen in detail and solved jointly.	S204: I cannot upload audio files in iBook Creator. I need urgent help. T3: Could you join the online guidance meeting this evening?
5	Peer intervention	Instructors and fellow students join in sharing their situations or problems and how they dealt with them.	S192: I cannot figure out how to send links to my videos to the examiners. S81: I have the same problem. S206: Copy the links in Word docs and attach the doc in the comments field.

The major types of textual intervention are:

- a. answering students' questions;
- b. elaborating and verifying students' ideas or thoughts;
- c. figuring out students' problems or challenges; and
- d. inviting students into discussions.

Video Intervention and Textual-Video Tutorial Intervention

Video interventions were exclusively used in the Canvas discussion forum by one instructor. The video contained a detailed explanation of students' questions with suggestions for possible learning resources. Textual-video tutorial interventions were mainly used in the Facebook group. Some instructors replied in written form and embedded links to video tutorials that could help students further understand the questions or content. Video interventions and textual-video tutorial interventions did not allow much discussion of the issues between instructors and students as students stopped raising questions or posting comments after this type of intervention. Survey data demonstrated that most respondents were satisfied with the video interventions that instructors used to support their learning process.

Figure 1.
Students' Assessment of Video Feedback (N=121)

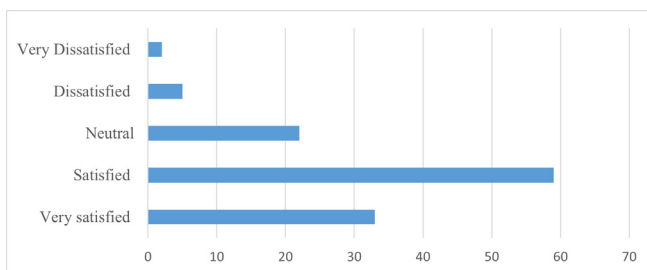


Figure 1 shows that most respondents were satisfied with the video interventions. This was because video feedback offered personalized feedback to the students, and students could also repeatedly use it. Some students did not know whether video feedback helped them or not, and a few remained dissatisfied.

Referral Intervention

In referral interventions, two or more instructors replied to students' questions and comments.

Instructors in both discussion forums engaged in referral interventions, but instructors' referral intervention frequency was much higher in the Facebook group than in the Canvas discussion forums (see Figure 2). This type of intervention allowed more dialogue and discussion among instructors and students.

The main activities of referral interventions are as follows:

- a. answering students' questions and explaining their comments;
- b. referring students' questions or comments to fellow instructors;
- c. joining fellow instructors in replying to students' questions and comments; and
- d. sharing reference resources (video tutorials and reading materials).

Peer Intervention

Peer interventions were more frequent in the Facebook group than in the Canvas discussion forum. The peers (e.g., students who worked together in small groups) were frequently engaged in sharing their experiences, answering each other's questions, and commenting on their opinions or posts. Instructors rarely engaged in peer intervention. The instructors let students engage in prolonged discussion in the Facebook group and did not intervene to answer questions. Peer intervention was very limited in the Canvas discussion forum, where instructors more commonly engaged in answering questions and comments.

The significant activities of peer interventions are as follows:

- a. posting questions, comments, or opinions;
- b. answering fellow students' questions;
- c. sharing experiences of solving a problem; and
- d. finding fellow students working in the same subject area or school level for further discussion in online meetings.

Table 3 shows the frequency of different interventions in the Facebook group and Canvas discussion forum.

Survey data also suggest that students were more active in the Facebook group than in the Canvas discussion forum. Instructors mainly used textual intervention in Canvas, while peer intervention was the most common intervention strategy on Facebook.

Table 3.
Overview of Instructors' Intervention Strategies in Facebook Group and Canvas Discussion Forum

Epistemic intervention strategies (EISs)	Facebook group	Canvas discussion forum
Textual interventions	26%	65%
Video or textual-video tutorial interventions	1%	7%
Referral interventions	12%	5%
Peer interventions	57%	5%
Remote interaction interventions	4%	18%

Figure 2.
Students' Degree of Activeness in the Facebook Group and Canvas Discussion Forum

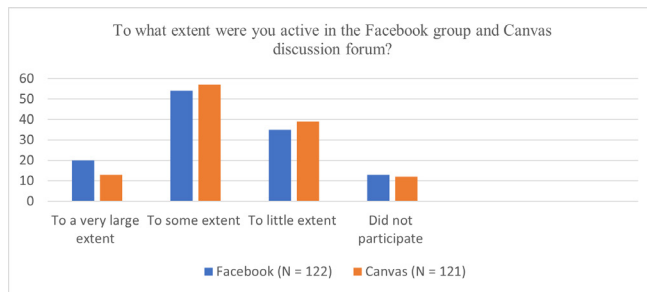
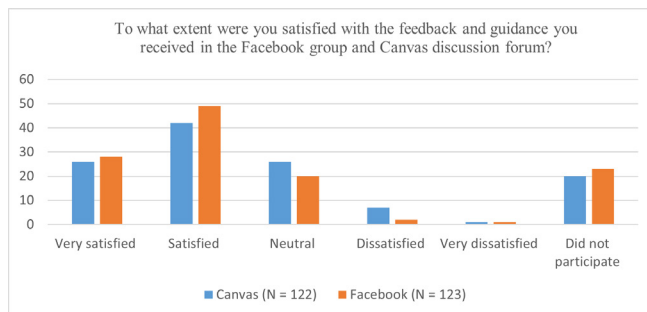


Figure 2 shows that only some students remained active in the discussion forums, and many reported that they were active to a little or very little extent. A slightly higher number of respondents were more active in the Facebook group than in the Canvas discussion forum. Most respondents were active to some degree in both forums, while some respondents did not participate in either.

Figure 3.
Students' Degree of Satisfaction with Instructors' Feedback and Guidance in Discussion Forums



As shown in Figure 3, most respondents were satisfied with the instructors' feedback and

guidance in the discussion. Slightly more students were satisfied with the feedback and guidance in the Facebook group compared to that of the Canvas discussion forum. One of the reasons for this was that instructors were quicker at responding to questions and comments on Facebook than in Canvas.

Remote Interaction Intervention

Instructors used remote interaction intervention to support students' learning processes in both discussion forums. The frequency of remote interaction intervention in the Canvas discussion forum was higher than in the Facebook group. The instructors asked students to join the Canvas discussion forum for more detailed answers to questions raised. Remote interaction interventions were the maximum support that instructors could offer to the students to help them learn collaboratively.

Survey data suggested that most students who participated in online meetings with instructors were satisfied with the engagement. Online meetings were part of the instructors' remote interaction intervention strategy.

Figure 4.
Students' Degree of Satisfaction with Instructors' Guidance in Online Meetings

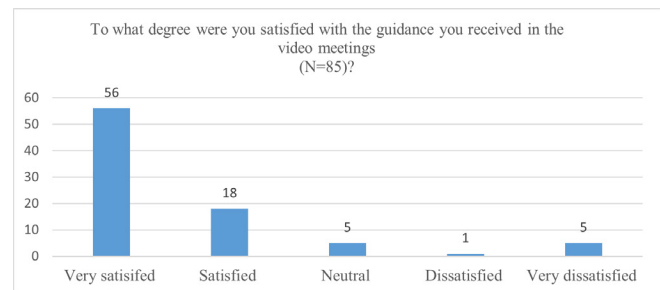


Figure 4 shows that respondents were *satisfied* or *very satisfied* with the instructors' guidance in the video meetings. The reason for this was that students were eager to engage with course instructors who could help them understand and solve problems. Some remained uncertain whether the video meetings helped them understand the issues, and a few were dissatisfied.

FINDINGS FROM ENA

We used a freely available online epistemic network analysis tool (<https://www.epistemicnetwork.org/>) to characterize and visualize six instructors' (T1, T2, T3, T4, T5, and T6) feedback-giving

strategies based on the five thematic codes outlined in Table 2. The depiction shows the structures of the relative importance of the different intervention strategies for each instructor below.

The ENA tool successfully visualized four instructors' feedback-giving strategies, but two instructors (T5 and T6) were not shown as their activities were low and unevenly dispersed in the Canvas discussion forum (Figure 5). There was a strong connection between referral and textual interventions for all instructors. T1 and T2 were more frequently engaged with textual, peer, video, and remote interaction interventions, T3 with referral, textual, and remote interaction interventions, and T4 with textual and referral interventions.

The ENA tool depicted five instructors' feedback-giving strategies in the Facebook group (Figure 6). These instructors were more frequently

engaged with textual, peer, and referral interventions. They were all strongly connected to peer intervention as they did not necessarily engage in the students' discourse in the Facebook group, reaffirming the findings from the thematic analysis. T1, T2, T3, and T6 were less frequently engaged with remote interaction interventions and textual-video tutorial interventions, whereas T4 was more frequently engaged with textual-video tutorial interventions.

DISCUSSION

In this section, we will first summarize our findings and then discuss the findings regarding how instructors' professional agency came into play in selecting the EISs to address students' problems and foster their learning in discussion forums (RQ1). Finally, we will discuss how students'

Figure 5.
ENA of Instructors in the Canvas Discussion Forum

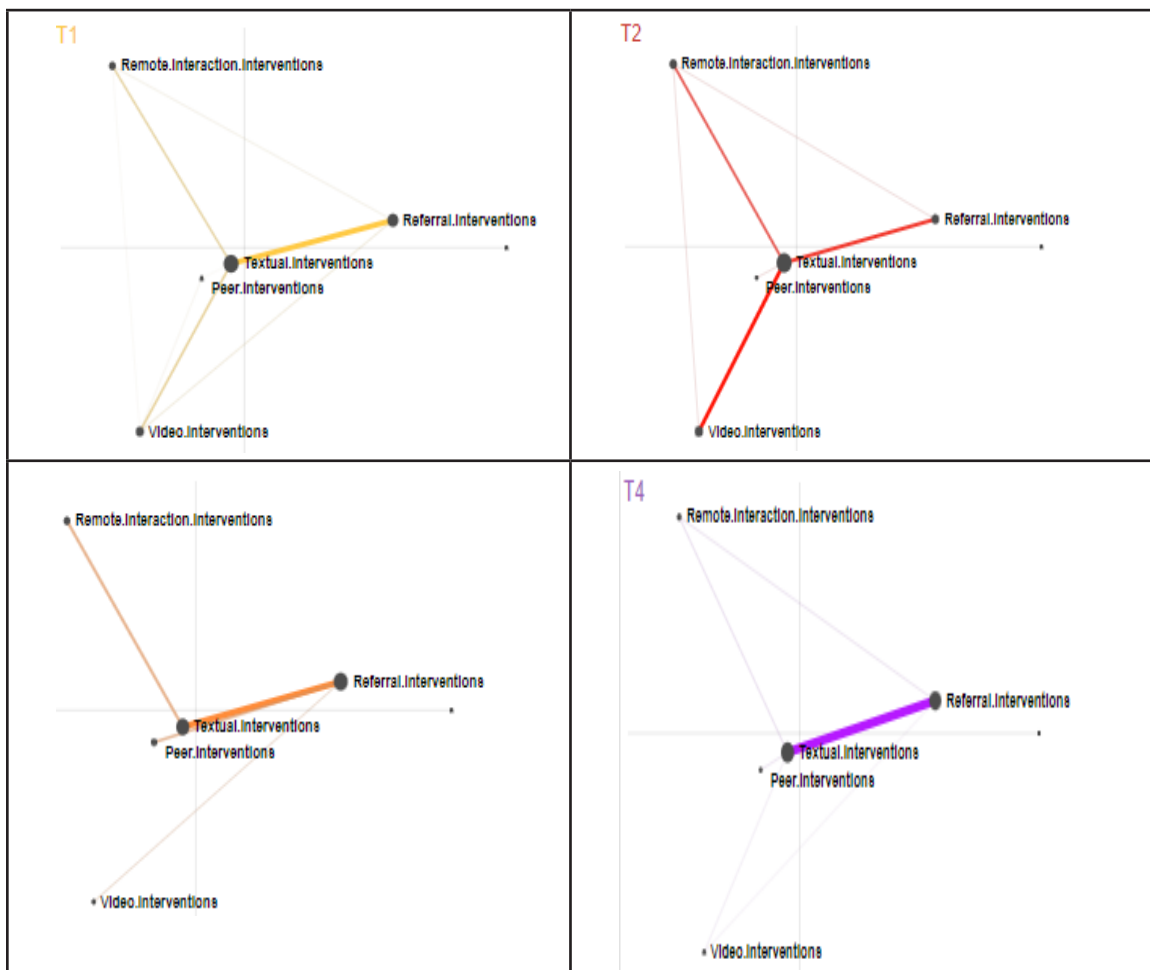
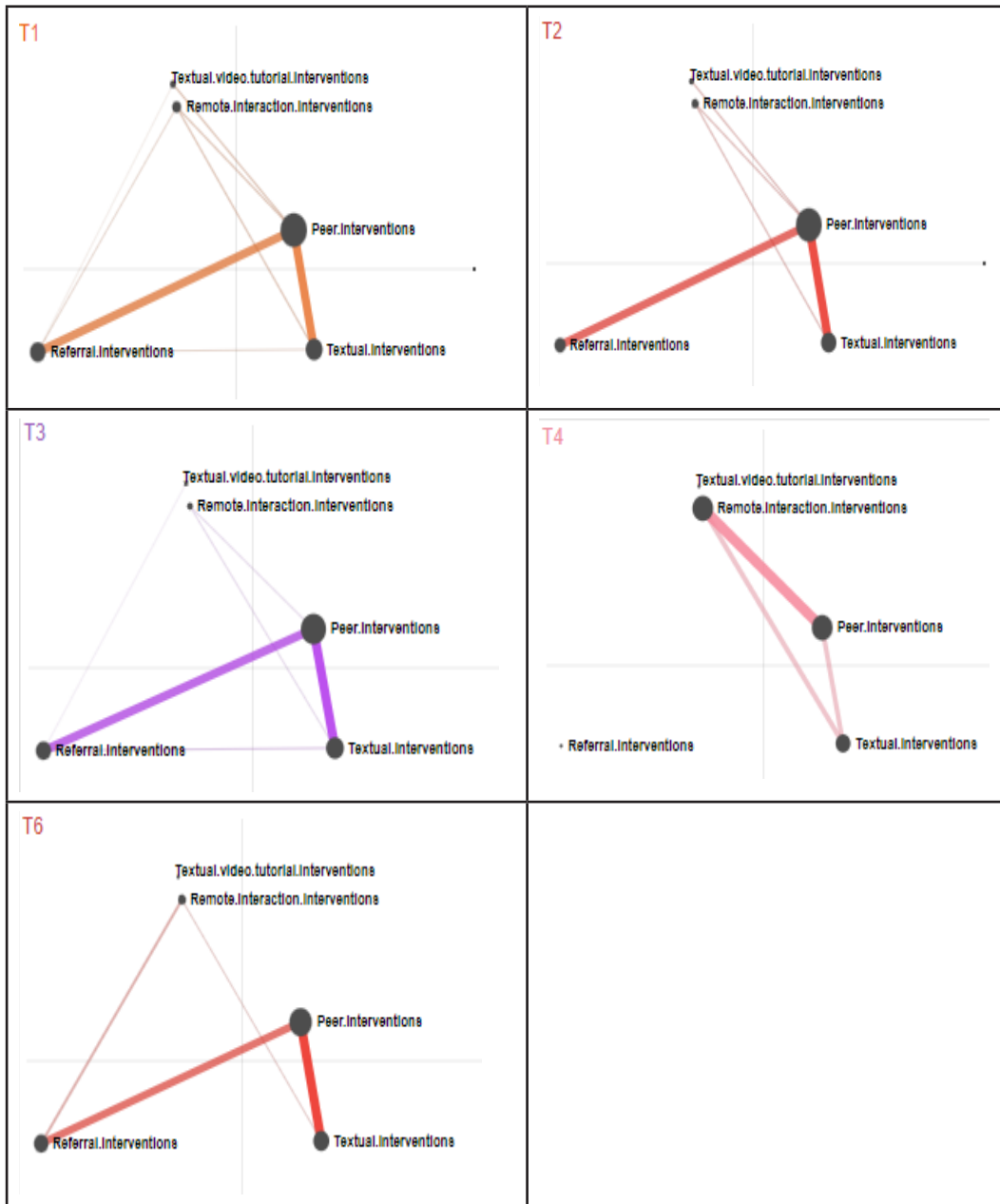


Figure 6.
 ENA of Instructors in the Facebook Group



agency influences instructors' selection of EISs to address students' problems (RQ2).

Epistemic Intervention Strategies

The analysis of the findings showed the instructors employed the five EISs to address students' learning problems in course discussion forums. We briefly summarize them below:

- **Textual intervention:** Instructors used written language to address students'

questions and comments in the discussion forums. It is the most common EIS that the instructors used to communicate with students and foster their engagement and learning, confirming the findings from previous studies that text-based interaction is the most dominant mode of interaction between participants in MOOCs (Oh et al., 2018; Shea et al., 2022).

- **Video or textual-video tutorial intervention:** Some instructors created short videos to provide detailed explanations and personalized feedback to students about their problems, which was well received by most students. It is a new form of pedagogical scaffolding in the MOOC. Some instructors replied to students' questions in written language and shared links to video tutorials to help students develop a deeper understanding of their problems. Videos can also assist students in developing a conceptual understanding of how to solve individual learning problems, thus enhancing their agency in learning (Clark et al., 2018; Engeness et al., 2020).
- **Referral intervention:** Instructors asked fellow instructors or facilitators to address students' problems when they are unsure about how to answer the questions themselves. It may foster instructor collaboration in facilitating students' learning. The more instructors communicate together concerning how they can address students' problems, the more effectively they can foster students' learning. Thus, the referral intervention can be a promising strategy to support students' learning in MOOCs.
- **Peer intervention:** Instructors allowed more peer interventions in the Facebook group discussion than in the Canvas discussion forum by not intervening in their activities. When students shared their experiences and reflections on how they solved their problems, instructors disengaged with peer discussions. Peer intervention can become a critical tool to foster peer collaboration, which develops students' critical thinking in MOOCs (Dyment et al., 2020; Oh et al., 2018).
- **Remote interaction intervention:** Instructors invited students to online, live guidance meetings to address their queries, especially for how-to-solve questions. Most students were satisfied with online guidance meetings that promoted social and collaborative learning in MOOCs (Singh & Engeness, 2021). Logical thinking or higher-order thinking is developed in and

through instructor-student interactions (Margaryan et al., 2015).

The abovementioned EISs can be grouped into two modes: communication and teamwork. Textual intervention and video intervention are based on communication, whereas referral, peer, and remote interaction interventions can be described as teamwork. However, these two modes (communication and teamwork) are not mutually exclusive. For example, in the referral intervention and peer intervention, the mode of communication was primarily the written text. On the other hand, the mode of communication in teamwork-based intervention included both written and spoken forms of language. These EISs emerged when instructors engaged in making sense of students' problems and scaffolding pedagogical supports to address the problems in the best possible manner. Thus, engaging with instructors' learning activities, figuring out problematic issues, and taking actions to address problems aiming to foster students' learning is the enactment of instructors' professional agency in teaching in online learning environments. In the next section, we discuss how instructors' professional agency came into play to devise appropriate pedagogical supports to solve students' problems.

Instructors' Professional Agency and Epistemic Intervention Strategies

The EISs emerged as a result of instructors' active engagement in making sense of students' learning problems (e.g., how to solve the examination assignments) and in scaffolding appropriate EISs to address the problems by mobilizing and creating resources. We conceive of this as instructors' professional agency in teaching (Edwards, 2015; Stetsenko, 2017), and agentic instructors can make appropriate pedagogical choices in when, how, and why to intervene in students' learning activities (MacLellan, 2017). For example, questions like how to submit the examination assignment, and what a particular term or expression in the course means were often immediately answered by the instructors in written texts. If students required more detailed explanations and personalized feedback, some instructors employed video or textual-video tutorial intervention that involves creating short video feedback and sharing this and other tutorials to answer students' questions and

deepen their understanding of the questions. Since the video feedback was posted in the discussion forums, all students could access it and learn from it, despite it being directed to one student. Creating video feedback was a challenging task as instructors had to organize their knowledge and present it succinctly. Video intervention can be taken as one of the sophisticated EISs that instructors could use to provide more detailed and personalized answers as well as feedback to students' questions and comments rather than just a mode of intervention. Creating videos to give feedback and address students' problems is a new form of scaffolding that can also enhance instructors' professional digital competence. Video can effectively assist students' learning and develop their agency in learning as students learn to understand and solve problems (Clark et al., 2018; Engeness et al., 2020).

When some instructors/facilitators were unsure about how to address students' questions, they asked fellow instructors with the expertise to address the questions more appropriately. Assessing who could correctly answer questions can be taken as the enactment of instructors' epistemic agency because "epistemically agentic teachers take responsibility for their own and their learners' cognitive advancement, and when they recognize gaps, they take steps to address them" (Maclellan, 2017, p. 144). Thus, enacting epistemic agency can foster communication and collaboration between instructors aiming to facilitate students' learning.

Likewise, instructors employed remote intervention to discuss the problems and resolve them collaboratively when they found students struggling with complex issues, such as creating multimodal texts in iBook Creator. Remote interaction between instructors and students is much-needed pedagogical support in MOOCs because students drop out of the course because of the lack of interaction with instructors (Gamage et al., 2020; Hew, 2016). Interacting with instructors encourages students' cognitive development (Shea et al., 2022). Most importantly, the agency in teaching and learning is enacted and developed in and through interaction and collaboration (Harasim, 2017; Singh & Engeness, 2021; Stetsenko, 2017).

Finally, the instructors allowed more peer interventions, especially in the Facebook group discussion, by not intervening in students'

activities. Instructors seemed to be aware of when, why, and how to intervene. They decided to disengage in students' activities when students shared resources, requested fellow students to share their experiences, and described their approaches to solving problems. The decision to disengage with peers during problem-solving may directly influence students' agency in learning. For example, the students did not engage in peer discussion in the Canvas discussion forum because instructors replied to each comment and question. This suggests that students may find it challenging to engage with instructors' direct answers to their questions, which may not provide room for further interpretation and discussions, reaffirming findings from the previous studies that instructors' more frequent intervention in students' learning may discourage students' engagement in peer discussion (Dixson et al., 2006; Mazzolini & Maddison, 2003). In large MOOC platforms, such as FutureLearn and Coursera, peer interaction as a learning strategy emerged partly due to the lack of opportunities to interact with course instructors, so students engaged with fellow peers to complement instructors (Kotzee & Palermos, 2021). However, in our case, peer intervention appeared as a well-thought-out pedagogical strategy that instructors employed to foster peer interaction, as long as the students engaged in sharing in reflecting on how they solved their problems in the Facebook group. Peer interaction in MOOCs is one of the most promising forms of learning that fosters collaboration leading to the development of students' critical thinking (Dyment et al. 2020; Oh et al., 2018).

Thus, the EISs were contingent upon the nature of the complexity of students' problems. Instructors' reasoned capacity came into play in figuring out challenging issues and mobilizing resources by using their professional repertoire of knowledge and skills. This capacity is called instructors' professional agency in facilitating students' learning in the online learning environment. This capacity is enacted when instructors position themselves as knowledgeable actors to assist and guide students in understanding and solving their problems by invoking available resources such as fellow instructors, students, and video tutorials (Edwards, 2015; Maclellan, 2017).

To sum up, these EISs were not planned activities but rather they emerged while instructors

volitionally engaged in making sense of and addressing students' learning problems, thus enacting their professional agency in scaffolding pedagogical supports to address students' questions.

Student Agency and Instructors' Epistemic Intervention Strategies

The analysis of the findings indicates that students were active in sharing their problems and experiences, and in seeking assistance in solving their problems, which were mainly related to the examination assignments. Agentic students have the capacity to know how to engage in learning, articulate their problems, and seek assistance to solve them (Engeness, 2021; Stetsenko, 2017). They also take on fellow participants' problems (Stetsenko, 2017). Whenever a student posted something in the discussion forums, the instructors would read and reply to it if it contained a question. For example, the instructors provided suggestions if students were wondering about what digital tools to use to create the examination assignment. The more students enacted their agency, that is, the more active they were in raising questions, seeking explanations, and attempting to develop a more logical understanding of tasks and problems, the more the instructors enacted their professional agency to intervene to address students' problems and provide guidance to them. Critical thinking is developed when instructors and students actively interact to question ideas, seek explanations, and solve problems collectively in MOOC discussion forums (Dyment et al., 2020; Oh et al., 2018). This indicates a reciprocal relationship between instructors' interventions and students' agency in learning in discussion forums.

However, we also observed nuances in the mutually influencing relationship between students' agency in learning and instructors' professional agency in intervening to facilitate and guide students' learning. For example, when students shared their experiences of solving problems and aided fellow students, the instructors employed peer intervention, which means they did not intervene in students' learning when students shared their experiences of how they resolved problematic issues. This suggests that the nature of students' postings in discussion forums may influence instructors' professional agency. It can also be instructors' more hands-off approach that allows students to take the lead in the discussion.

We believe that this was the instructors' conscious decision to allow students to share how they solved the problems. Allowing students to be exposed to different ways and perspectives of solving problems also assists them in interpreting and solving their individual problems. Vygotsky (2012) also suggests that we learn through the ideas and approaches others have used in solving their problems, as they might function as conceptual models to understand and solve our own problems.

Furthermore, discussion forums may be developed into spaces and tools (Bozkurt & Keefer, 2018) for enacting and developing the agency of both instructors and students. Questions and comments posted by students may reflect their attempts to develop a conceptual understanding of course content and examination assignments. That means students' conceptual understanding of problematic issues was mainly disorganized (e.g., using everyday language) and was in the early stages of intellectual maturity. Their queries, comments, and thoughts as epistemic beliefs and stances might be considered manifestations of the "trial and error" stage of learning in a digital learning environment (Engeness, 2021). Intervening in such a process of learning was a challenging and delicate epistemic task for instructors. For example, the more instructors tended to answer students' questions, the shorter the discourse became among students, especially in the Canvas discussion forums. This suggests that instructors need to reconsider their approach to directly answer students' questions and foster discourse among students through which they can learn to solve problems collaboratively, which reaffirms the findings from previous studies (Ntourmas et al., 2019).

Finally, systematic interaction and collaboration between instructors and students may foster students' ZPD. The ZPD is created when instructors and students engage in interaction, during which instructors assess students' understanding of academic content, recognize insufficient knowledge or understanding, and devise strategies to develop and expand students' knowledge (Vygotsky, 2012). The EISs can be taken as instructors' attempts to develop students' scientific understanding of academic content and learning problems. As stated by Vygotsky (2012), students' questions and comments in discussion forums can be taken as the expression of spontaneous (every day) concepts

that are formed while engaging in solving practical problems. These concepts are expanded into systematic, logical concepts when instructors use their professional knowledge (scientific understanding) to reorganize them. We also argue that EISs may contribute to creating a relational zone of learning (Goldstein, 1999) as instructors and students develop a sense of belonging and community, which is critical to learning in an online environment where participants are remotely located and mostly unacquainted with one another (Garrison, 2017; Shea et al., 2022).

PEDAGOGICAL IMPLICATIONS AND LIMITATIONS OF THE STUDY

This study has some important implications for online, especially MOOC, pedagogical practices. First, understanding students' learning problems and addressing them demands more dialogue with students through different modes of communication to solve problems more productively. The instructors need to be aware of their professional knowledge and competence when choosing various intervention strategies in online learning environments.

Second, online learning environments demand that instructors enact and be aware of their epistemic agency. They may not be able to understand and solve all the students' problems individually, so they should rely on their fellow instructors. The more instructors are involved, the more productively they can solve such problems and expand their own professional knowledge. Third, answering students' every comment and question may discourage peer engagement in learning and restrict student agency in learning. Providing direct answers to students' questions is tempting for instructors, but it may narrow down the possibility of expanding dialogue, thus diminishing the possibility of fostering students' agency in learning. Thus, when, why, and how to intervene in students' learning may be the most challenging aspect for instructors as they should balance different factors. Instructors need to be mindful in enacting their epistemic agency.

Finally, the study had some limitations. For example, we could not provide direct statements of the research participants' spoken utterances to make our claims more robust due to personal data protection regulations. The study only used data

from one module of a Canvas discussion forum. Arguably, using data from all the Canvas discussion forums we had access to might have provided a better picture of the instructors' intervention strategies. Thus, we compared all Facebook group discussion data with data from a single Canvas discussion forum. This asymmetrical comparison might not provide a balanced picture of the nature of instructor EISs in these two discussion forums. Moreover, we could not highlight the role of technologies in developing and expanding epistemic activities. Further research is needed to explore these limitations.

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