

THE USE OF GUIDED, ROLE-BASED, AND SMALL GROUP DISCUSSION BOARD TO FACILITATE
PEER INTERACTION IN HIGHER EDUCATION ONLINE COURSES

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This study investigated students' perceptions of peer interaction using an online discussion board that applied guided, role-based, and small group instructional strategies in a graduate online course. An explanatory sequential mixed methods research design was adopted, modified, and used in this study. Four data sources were used: (1) online surveys, (2) semi-structured individual interviews, (3) online discussion board posts, and (4) online discussion board logs. Data collection was conducted over approximately 4 months, from August 22 to December 16, 2022, for 17 participants enrolled in the target graduate online course. For 15 weeks, the students' online discussion system logs and posts were collected and analyzed weekly, serving as initial data to refine online surveys and personal interview questionnaires. Descriptive statistics were employed to analyze data from 15 completed online surveys and the online discussion system logs. A total of 1,044 online discussion posts were gathered, and individual interviews were conducted with 14 students totaled 604.9 minutes. Content analysis was applied to analyze qualitative data, with two researchers coding the interview transcripts to ensure data analysis triangulation.

The results of this study revealed both positive and negative perceptions of students regarding the use of online discussion boards. Role-based discussions helped create diverse voices and foster ownership, responsibility, and community, and small group discussions

increased engagement and intimacy among students. Additionally, clear instructions and instructor-provided guiding questions supported students' understanding and engagement. However, a free discussion was limited due to excessive role immersion, and a student's low participation or late posting due to the small discussion group size hindered the progress of the entire discussion. In particular, factors such as full-time job status and deadlines for major assignments negatively influenced student participation. Overall, the provided online discussion board facilitated meaningful interaction, but the need for improvement for optimal design has been identified. Modifications related to task arrangement, role assignment methods, discussion period, and article selection method were suggested. This study provided valuable insight into how applying instructional strategies to an online discussion board can help promote peer interaction. It also demonstrated the significance of moderators in online discussions. These findings offer practical guidelines for designing effective online discussion boards.

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Table of Contents

Chapter 1: Introduction	1
Problem Statement	1
Purpose of the Study	4
Research Questions	5
Significance of the Study	6
Implications of the Study	8
Chapter 2: Literature Review	10
Online Learning	10
Peer Interaction	11
Discussion Boards (Forums)	16
Research Framework	19
Theoretical Framework: Sociocultural Perspective.....	19
Instructional Strategy: Guided and Role-based Discussion in a Small Group	21
Chapter 3: Methods	27
Study Design	27
Course Design	28
Researcher Role	32
Participants	33
Evaluation Factors	34
Peer Interaction	34
Student Satisfaction on Discussion Activity	46
Data Collection	49
Online Surveys.....	49
Semi-structured Individual Interviews	50
Online Discussion Board Logs	51
Online Discussion Board Posts	53
Data Analysis	54
Quantitative Data.....	54
Qualitative Data	55
Chapter 4: Results	58
Introduction	58
Online Survey	59
Participant Biographical Information.....	59
Peer Interaction	60
Online Discussion Board Activity.....	62
Overall Feedback.....	63
Individual Interview	64

Students' Perceptions of Peer Interaction Using an Online Discussion Board	65
Students' Perceptions of an Online Discussion Board Activity	71
Discussion Posts.....	91
Discussion Observational Data per Week	93
Authentic Interaction based on Role Performance.....	99
Chapter 5: Discussion and Conclusions.....	101
Introduction	101
Summary of the Study	101
Research Question 1: How do Students Perceive Discussion Board Activities Designed Using Guided, Role-based, and Small Group Instructional Strategies?	103
Research Question 2: How do Guided, Role-based, and Small Group Instructional Strategies Affect Peer Interaction in Online Discussion Board Activities?.....	109
Additional Important Aspects	117
Limitations of the Study	129
Implication for practice	130
Provision and convenient access of clear guideline	130
Flexible discussion schedule and frequency	131
Provision of guiding questions every week.....	131
Two-step posting: answer question prompts first, then provide comments on other posts	132
Provision of multiple options of posting	132
Provision of a reading list with two options.....	132
Discussion groups of four to six students	133
Assignment of a moderator and free choice of remaining roles	133
Instructor's timely feedback	134
Implication for Research	134
Conclusions.....	135
References.....	139
Appendix A	150
Online Survey	150
Appendix B	157
Study Invitation Email to Instructors	157
Appendix C	159
Interview Protocol	159
Appendix D.....	164
Participant (Student) Invitation Email	164
Appendix E	166
Online Discussion Board Manual.....	166
 Curriculum Vita	

Chapter 1: Introduction

Problem Statement

A growing number of people are taking online courses for various reasons, such as busy schedules, economic circumstances, and personal needs, and accordingly, interest in the quality of online learning is increasing (Lesht & Schejbal, 2004; Mensch & Ali, 2007; Perrotta & Bohan, 2020; Sher, 2009; Song & McNary, 2011). The advancements in computer and communication technologies have led to the development of various tools and software, which have been adopted into learning environments to improve the quality of online learning. LMS (Learning Management System) such as Canvas, Blackboard, and Google Classroom, real-time video conferencing software such as Zoom, and online communication software such as Slack are representative educational tools. Despite these efforts, online learning still receives many criticisms for its quality, one of the main criticisms being the lack of face-to-face physical interaction (Ala et al., 2021; Belcher et al., 2015; Gikandi et al., 2011; Sher, 2009).

Interaction is the set of actions that students perceive, comprehend, and acquire as they engage with and navigate their surroundings throughout the learning process (Moore, 1989; She et al., 2021; Song & McNary, 2011). Interaction can also simply mean communication between students and instructors or students that occurs in the learning process (Belcher et al., 2015; Lin et al., 2017; Zhu, 2006). Therefore, interaction is considered one of the most critical components influencing students' learning experiences and learning outcomes (Belcher et al., 2015; Bernard et al., 2009; Lin et al., 2017; Moore, 1989; She et al., 2021; Sher, 2009; Song & McNary, 2011; Yilmaz & Yilmaz, 2019; Zhu, 2006).

Unlike interaction in a traditional classroom environment, where students can interact naturally with other students at the same time in the same place without the help of other tools, interaction in an online environment is only possible through computer-aided tools (Song & McNary, 2011). Many scholars have studied unique online interactions, and the leading scholar among them was Michael G. Moore. Moore (1989) introduced three types of online interactions: student-content, student-instructor, and student-student. Student-content is the interaction between students and online learning content, and the student-instructor is the interaction between the student and the instructor providing the learning content (Moore, 1989; Sher, 2009). Student-student interaction refers to students sharing learning content information and discussing learning content through computer-based activities (Moore, 1989; Sher, 2009).

The most popular tool for conversational exchange currently used in online learning is a discussion board (Al-Husban, 2020; de Lima et al., 2019; Song & McNary, 2011; Thomas, 2002). A discussion board allows students to participate in conversations in an asynchronous manner, even if they are unable to attend live courses or meetings due to time and space constraints or are reluctant to participate in live discussions due to language barriers (de Lima et al., 2019). This asynchronous approach can improve the quality of discussion by allowing students sufficient time to think and organize themselves (Hara et al., 2000). In addition, since conversations exchanged with peers and instructors are saved on the board, students can revisit the posts multiple times as needed, ultimately resulting in improved student comprehension (Croxtton, 2014; Delaney et al., 2019; de Lima et al., 2019; Mensch & Ali, 2007; Ruane & Lee, 2016).

Despite these advantages, previous studies on peer interaction using discussion boards have revealed many negative outcomes (Delaney et al., 2019; Lesht & Schejbal, 2020; Moore et al., 2016). Based on previous studies, the four challenges associated with negative outcomes are summarized as follows: (1) lack of clear guidelines regarding the use of discussion boards, such as purpose, basic rules, and expected actions, (2) poorly designed discussion board structure, (3) lack of actions to promote student motivational engagement, (4) lack of instructor engagement or involvement (Croxtton, 2014; de Lima et al., 2019; Lesht & Schejbal, 2020; Xia et al., 2013). More specifically, some students were overwhelmed by the huge number of posts due to poorly designed discussion board activities (de Lima et al., 2019; Lesht & Schejbal, 2020). Other students noted that discussion board activities are often a waste of time when there is no clear guidance on what activity is about or what to do (Buelow et al., 2018; Croxtton, 2014; de Lima et al., 2019; Lesht & Schejbal, 2020; Moore et al., 2016). As one student stated, "Posting/forums aren't helpful unless there is a clear sense of expectation" (Lesht & Schejbal, 2020, p.7).

Indiana University Bloomington's department of Instructional Systems Technology (IST) offers a number of accredited online programs at the graduate level. However, as revealed in the literature review, there were negative feedback of using discussion boards for peer interaction in IST online courses. A leading researcher, currently an online doctoral student, has frequently witnessed many negative students' reactions to using discussion boards. Some students mentioned using the discussion board only to prove they were doing the assignments well. Discussion boards are not being used as supporting tools for peer interaction in online learning. Therefore, identifying the causes and difficulties that students face when using

discussion boards and finding practical methods to promote peer interaction in discussion boards was projected to help to improve the quality of online courses in IST departments.

Purpose of the Study

As shown in previous studies, students need peer interaction for quality online learning and think discussion boards are one of the best tools to support peer interaction in online learning (Al-Husban, 2020; de Lima et al., 2019; Song & McNary, 2011; Thomas, 2002). However, previous studies have revealed a number of concerns or problems associated with using discussion boards for peer interaction (Croxtton, 2014; de Lima et al., 2019; Lesht & Schejbal, 2020; Xia et al., 2013). This study selected, adopted, modified, and applied guided instruction, role-based, and small group discussion instructional strategies to the chosen IST course to alleviate problems related to the use of discussion boards identified in previous studies and the lead researcher's personal experience. This study aimed to investigate whether applying three instructional strategies to the chosen IST graduate course can help promote asynchronous interaction among students. In particular, through online surveys and individual interviews, the purpose of this study was to explore the participating students' perceptions on whether using the three instructional strategies on the discussion board would be helpful for interaction between students. In addition, another purpose was to objectively examine whether meaningful interactions occurred between students by collecting and analyzing discussion posts uploaded by students during the 15-week course period. Finally, this study aimed to find practical and applicable findings for the design of online discussion boards by analyzing the content, occurrence frequency, and order of discussion posts.

Research Questions

In order for the discussion board to facilitate interactions among students, three instructional strategies were selected based on a literature review and adopted, modified, and appropriately applied to the target course. The three instructional strategies are (1) guided instruction, (2) role-based discussion, and (3) small group discussion. The following two research questions were developed to investigate whether these three instructional strategies applied to the online asynchronous discussion learning activity helps students to interact with their peers. To seek the answers to these research questions, evaluation factors, data sources, data types, and analyses corresponding to each research question were determined and summarized in Table 1.

RQ1: How do students perceive discussion board activities designed using guided, role-based, and small group instructional strategies?

RQ2: How do guided, role-based, and small group instructional strategies affect peer interaction in discussion board activities?

Table 1

Matrix of Research Questions, Evaluation Factors, Data Types, Data Sources, and Analyses

Research questions	Evaluation factors	Data sources	Data types	Analyses
RQ1: How do students perceive discussion board activities designed using guided, role-	Discussion activity	Online survey	Quantitative	Descriptive statistics
	satisfaction	Individual interview	Qualitative	Content analysis

based, and small group instructional strategies?				
RQ2: How do guided, role-based, and small group instructional strategies affect peer interaction in discussion board activities?)	Peer interaction	Discussion board log	Quantitative	Descriptive statistics
		Discussion board posts	Qualitative	Descriptive statistics / Content analysis
		Online survey	Quantitative	Descriptive statistics
		Individual interview	Qualitative	Content analysis

Significance of the Study

Along with the popularity of online learning, criticism has also been raised about the limitations of interaction between learners and other learners as well as between learners and instructors due to the non-face-to-face learning environment. In particular, due to the Coronavirus that hit the world in the winter of 2019, all people on the earth were forced to live and continue to study in an online environment. This pandemic has presented a vast experimental period in which people are forced to experience the intrinsic limitations and the potential of online learning (Ala et al., 2021; Ali, 2020).

Technological advances have made it possible to provide online learners with a variety of learning activities that are often found in face-to-face learning environments. In particular,

the introduction of real-time video conferencing software such as Zoom and the explosive increase in its usage after the pandemic showed the potential for interaction limitations in online learning environment. However, many online learners who prefer a flexible learning style do not seem to welcome real-time video conferencing. A lot of studies have reported that many enrolled students in graduate online courses do not like activities that require simultaneous gathering because they have to work full-time or support their families (Gardner & Gopaul, 2012; Lesht & Schejbal, 2020; Moore et al., 2016; Watson, 2010). However, it was expected that peer interaction is an essential component in the learning process and should be supported in online learning. Therefore, there was a need for a practical approach to supporting peer interaction that meets the needs of online students. Indeed, in a study by Lesht and Schejbal (2020), one student addressed that students with full-time jobs could also participate if flexible peer interaction activities were provided.

Given its flexibility, one of the most accessible and easy-to-adopt tools for providing graduate students with peer interaction was a discussion board. A discussion board is provided as default in all Learning Management Systems (LMS), and multiple boards can be created and operated at the same time. In addition, through literature review, critics and challenges related to the use of discussion board were identified, such as the lack of clear guidelines for learning activities, poorly designed discussion board structure, and lack of instructor involvement. As a practical solution for this, three instructional strategies that have shown educational effects in previous studies were well combined and applied to the discussion board of the target IST graduate course.

The results of this study might show that the effective application of instructional strategies on discussion boards can positively influence interactions among students in graduate online courses. Additionally, this study might demonstrate the potential of discussion boards as a tool to facilitate peer interaction in online learning. Finally, the findings of this study might be helpful to those who study discussion boards as a tool to support peer interaction in an online learning environment. In addition, the results of this study might be a good reference for instructional designers, content designers, and instructors who apply online discussion boards to actual educational environments.

Implications of the Study

In this study, there were several terms that are different words, but were treated as the same word in their meaning. "Discussion board" and "discussion forum" mean asynchronous online discussion board, "online learning," "distance learning" and "remote learning" are online learning, "role-playing" and "role-based" are role-based, and finally "peer interaction," "peer communication," "peer-to-peer communication," and "student-student interaction" were considered peer interaction.

To enhance the proposed study's validity and reliability, a multi-pronged approach was adopted, involving the collection of data from three different sources: online survey responses, individual interview scripts, and discussion board logs and posts. Although the interviews were conducted by one researcher, all interview scripts were subjected to scrutiny and coding by two researchers to ensure reliability. This coding process was iterated until the two researchers agreed on all codes, categories, and themes that were generated.

A convenient sampling method allowed a lead researcher to select students with characteristics that differ from regular students (e.g., all students are graduate students who take online courses). These characteristics might influence the results of the proposed study. In particular, for graduate students already accustomed to independent learning, peer interactions might not significantly impact learning (Moore et al., 2016). Also, it was supposed that participants were online degree/certificate program students. In that case, they might leave positive comments or feedback on the given asynchronous online discussion boards, as they might have already experienced or somewhat expected the various software and methods available online. On the contrary, the flexibility of online courses is one of the reasons for attracting many students, so online students might have an adverse reaction to peer interaction activities that require additional time and effort (Lesht & Schejbal, 2020; Moore et al., 2016; Sher, 2009; Watson, 2010).

Chapter 2: Literature Review

To build a contextual framework for this study, previous studies on online learning, peer interaction, and discussion boards were reviewed and discussed.

Online Learning

The advancement and the introduction of information, communication, and technology (ICT) into the learning environment began to change the paradigm of education and introduced the concept of online learning where people can learn anywhere and at any time while overcoming space and time constraints of the traditional classroom-based learning environment (Delaney et al., 2019; Mensch & Ali, 2007; Perrotta & Bohan, 2020; Ruane & Lee, 2016; Sher, 2009). Online learning refers to a form of education that is conducted outside of the traditional classroom and is a method of learning that takes place over the Internet (Perrotta & Bohan, 2020; Rapanta et al., 2020; Ruane & Lee, 2016; Sadiku et al., 2018). Online learning is used in various fields with e-learning, distance learning, and remote learning; however, in this study, online learning was used as a representative term. In particular, online learning refers to a learning environment in which the discussion board provided by LMS can be used through the Internet.

The introduction of online learning presented a new learning experience that people could not experience in a face-to-face classroom, that learning can be done anytime, anywhere if the Internet is connected (Delaney et al., 2019; Mensch & Ali, 2007; Perrotta & Bohan, 2020; Ruane & Lee, 2016; Sher, 2009). In a traditional classroom-based education system, a student refers to students of a certain age, and education refers to a K-12 formal education or higher education such as a university. However, with the introduction of online learning, people from

underprivileged backgrounds who did not receive formal education and those who desired to learn new things had received an opportunity to learn. Online learning also brought the concept of continuous learning, which can be engaged in according to one's need until death for a wide assortment of reasons, such as promotion, certification, knowledge improvement, skill acquisition, and degree acquisition. The demand for online courses and higher education degree programs has been growing steadily. In particular, interest in online learning is growing more than ever as all learners are forced to move to an online environment due to the COVID-19 outbreak in 2019 (Ala et al., 2021; Khoshnevisan & Rashtchi, 2021; Perrotta & Bohan, 2020; Rapanta et al., 2020).

The critics of online learning has been steady since its introduction, but due to COVID-19, interest in and cautions about the quality of online learning is also increasing (Rapanta et al., 2020). One of the leading challenges identified is the feeling of isolation or disconnection from the main campus or other people (Canty et al., 2020). In a non-face-to-face online learning, direct interaction among people can be inevitably limited (Mensch & Ali, 2007; Sher, 2009) compared to classroom-based environments where students can naturally communicate with each other in the same place at the same time. The physical distance between people may bring gaps and misunderstandings in their communication, which may negatively affect the learning outcome (Moore, 1989; Sher, 2009).

Peer Interaction

Interaction is generally defined as "mutual or reciprocal action or influence" in a dictionary (Merriam-Webster's Collegiate Dictionary, n.d.). If applying this meaning to learning, interaction is the series of actions that students explore, understand, and acquire learning

content while interacting with the surrounding environment in the learning process (Moore, 1989; She et al., 2021; Song & McNary, 2011). An interaction also refers to communication between students and teachers or students in the learning process (Belcher et al., 2015; Lin et al., 2017; Zhu, 2006). Without a doubt, interaction is considered one of the most important components influencing a student's learning experience and outcomes (Belcher et al., 2015; Bernard et al., 2009; Lin et al., 2017; Moore, 1989; Sher, 2009; She et al., 2021; Song & McNary, 2011; Yilmaz & Yilmaz, 2019; Zhu, 2006).

In non-face-to-face online learning, these interactions can be inevitably limited (Mensch & Ali, 2007; Sher, 2009) compared to classroom-based environments where students can communicate naturally with each other at the same time and in the same place (Song & McNary, 2011). In other words, an interaction that occurs in an online environment is different from classroom-based interaction. In online learning, students can only interact with instructors and peers through computer-aided media such as email, chat rooms, and discussion boards (Song & McNary, 2011). Moreover, this physical distance between students or students and instructors in an online environment may bring gaps and misunderstandings in their communication, which may negatively affect the learning outcome (Lin et al., 2017; Mensch & Ali, 2007; Moore, 1989; Sher, 2009). The importance of interaction in learning and the fundamental difference between online and offline interactions has raised the need for a deeper understanding of interactions in online environments (Gillett-Swan, 2017; Song & McNary, 2011).

To meet this need, a lot of scholars have studied online interaction, among which Moore (1989) introduced three types of interaction: (1) student-content, (2) student-instructor,

and (3) student-student. Student-content is the interaction between the student and the learning content, and student-instructor is the interaction between the student and the instructor providing the learning content (Moore, 1989; Sher, 2009). Student-student interaction refers to all activities where students share information and discuss learning content through computer-based activities (Moore, 1989; Sher, 2009). Although student-content and student-instructor interactions are accepted to have positive effects on learning, the learning effects of student-student interactions are still controversial (Croxtton, 2014; Lesht & Schejbal, 2004; Moore et al., 2016).

Moore (1989) stated that student-student interaction is an essential resource for learning, and Sher (2009) addressed that student-student interaction had a positive effect on learning performance and satisfaction in online learning. She et al. (2021) also pointed out that students who interacted more frequently with their peers in online learning showed higher levels of learning satisfaction. Ala et al. (2021) stated that student-student interaction helped students quickly adapt to online learning during the COVID-19 pandemic. In addition, many studies have shown that student-student interaction has a positive effect on learning outcomes and satisfaction in online learning (Bernard et al., 2019; Sher, 2009; Tenenbaum et al., 2020).

On the contrary, some scholars have argued that student-student interaction is not related to learning and even harms student learning performance and satisfaction in online learning (Arbaugh & Rau, 2007; Kuo et al., 2013; Liu, 2008; Moore et al., 2016). Lesht and Schejbal (2020) even reported conflicting results for student-student interactions in online learning: some students claimed, "it was waste of time" (p.6), and others mentioned, "that was useful and interesting" (p.7). Therefore, more empirical studies are necessary to draw

conclusions about the educational effects of student-student interactions (Borup et al., 2020; Moore et al., 2016).

Four challenges that students experience when interacting with peers in online learning have been identified in previous studies: (1) individual efforts, (2) time commitment, (3) poorly designed instruction or without clear guidelines, and (4) lack of instructor involvement.

Unlike interactions that occur naturally in the classroom, online interactions only take place through computer-mediated tools such as email, Slack, Zoom, or Canvas, so students need self-management skills to navigate time, space, and learning materials (Croxtton, 2014; Song & McNary, 2011; Xia et al., 2013). As activities to support peer interaction are presented as a form of collaboration, skills such as punctuality, responsibility, and effective communication are also required (Xia et al., 2013). It is challenging to set a meeting time and place without the active participation of all students in the class or group (Mensch & Ali, 2011). Students also have to adapt to new skills, such as technology use, new rules of conduct, new course materials, and peers (Ruane & Lee, 2016; Xia et al., 2013). Therefore, students taking online courses need more attention and effort to acquire the skills necessary for peer interaction activities.

Many students enrolled in online courses do not like group activities that require more time to work because they have to work full-time or support their families (Gardner & Gopaul, 2012; Lesht & Schejbal, 2020; Moore et al., 2016; Watson, 2010). Some students said, "work full-time and I'm busy with my family most of the time I'm not working" (Moore et al., 2016, p.9). As such, time commitment is one of the challenges online students encounter when interacting with peers (Lesht & Schejbal, 2020; Moore et al., 2016; Sher, 2009; Watson, 2010).

Poorly designed activities or lack of clear guidelines can be a challenge for students. Students felt overwhelmed by a lot of posts due to a poorly designed discussion board structure (de Lima et al., 2019; Lesht & Schejbal, 2020). When there are no clear instructions on what this activity is about and what to do, students stated they often waste time not knowing what to do (Buelow et al., 2018; Croxton, 2014; de Lima et al., 2019; Lesht & Schejbal, 2020; Moore et al., 2016). One student noted, "Posting or forums aren't helpful unless there is a clear sense of expectation" (Lesht & Schejbal, 2020, p.7).

Lack of participation by the instructor can make it difficult for students to engage in peer interaction activities (de Lima et al., 2019; Lesht & Schejbal, 2020). Instructors play a critical role in supporting quality interactions among students while presenting topics, providing timely feedback, facilitating discussions, and helping group cohesion in online learning (Buelow et al., 2018; de Lima et al., 2019; Ladyshewsky, 2013; Lesht & Schejbal, 2020). Lack of timely feedback in online interactions can lead to negative consequences such as student frustration or decreased student participation, which can be solved through appropriate instructor intervention (Dringus & Ellis, 2005; Mazzolini & Maddison, 2007). Kucuk and Richardson (2019) also emphasized that the presence of instructors influences students' emotional and behavioral engagement in the learning process.

The previous studies demonstrate that students' perceptions of peer interaction are pretty mixed. Although most students agree that peer interaction is essential in online learning (Borup et al., 2020; Croxton, 2014; Lesht & Schejbal, 2020; She et al., 2021), actual students' feedback on peer interactions differed according to learner characteristics and instructional strategies (Croxton, 2014; de Lima et al., 2019; Lesht & Schejbal, 2020). While students of

traditional ages, such as undergraduates, felt that peer interaction was essential and helpful (Croxtton, 2014; Lesht & Schejbal, 2020), students with full-time jobs, family responsibilities, or aiming to acquire professional skills felt that peer interaction was unnecessary (Croxtton, 2014; Gunawardena et al., 2010; Lesht & Schejbal, 2020). Students expressed higher satisfaction with peer interactions when provided with adequate and timely feedback and instructor's regular monitoring in small groups following clear guidelines on topics of student interest (de Lima et al., 2019; Lesht & Schejbal, 2020; Moore et al., 2016; Song & McNary, 2011). Lesht and Schejbal (2020) stated that even students with full-time jobs could be engaged if flexible peer interaction activities were provided. In summary, it can be seen that student satisfaction increased when well-designed peer interaction activities were provided according to the given learning context (Croxtton, 2014; de Lima et al., 2019; Lesht & Schejbal, 2020; Xia et al., 2013).

These structural problems and time issues related to peer learning activities may be solved by implementing effective discussion activities. For example, creating and running a small discussion group of four students may solve the problem of discussion threads that are too long. Providing clear instructions and rubrics may help students save time and effort in understanding and adapting to new activities. The purpose of this study is to examine whether student-student interaction can be well supported when a discussion board is implemented and provided based on role-based small group discussion activities with clear guidelines.

Discussion Boards (Forums)

A discussion board is one of the primary tools developed for online dialogue exchange (Al-Husban, 2020; Aloni & Harrington, 2018; Bonk et al., 1998; Bonk & King, 1998b; de Lima et al., 2019; Song & McNary, 2011; Thomas, 2002). A discussion board is an asynchronous way to

engage students who cannot participate in real-time discussions due to time constraints or language barriers (Aloni & Harrington, 2018; de Lima et al., 2019; Nandi & Chang, 2010). A discussion board also gives students time to think and organize themselves on the topic presented. At the same time, it provides an opportunity to hear diverse opinions from instructors and peers, enhancing students' knowledge and consequently improving the quality of discussions (Aloni & Harrington, 2018; Croxton, 2014; Delaney et al., 2019; de Lima et al., 2019; Mensch & Ali, 2007; Ruane & Lee, 2016).

In effect, previous research indicates that on discussion boards, students gain a deeper understanding of a topic presented by uploading their posts to the board to share their opinions with peers and instructors, commenting on other posts, or continuing to discuss the same topic (Aloni & Harrington, 2018; Kim, 2013; Nandi & Chang, 2010). Students can also create new knowledge based on deep understanding and ongoing discussions with peers or instructors through discussion board activities (Aloni & Harrington, 2018).

The basic structure of these discussion boards is closely related to socio-cognitive theory (Bonk & Cunningham, 1998; Bonk & King, 1998a). This theory explains that much of learning occurs through collaborating with peers, sharing understanding, generating new knowledge, reflecting on what has been learned in the learning process, and applying it to new environments (Bonk & Cunningham, 1998; Bransford et al., 2000; Croxton, 2014; Day & Goldstone, 2012; Delaney et al., 2019; de Lima et al., 2019). Asynchronous online discussion activities are closely related to collaborative learning, authentic learning, constructivism, social context, and knowledge construction: multiple learners continuously exchange opinions on the same topic on a discussion board to increase their understanding of the topic.

Students, when engaged in authentic learning, can have time to think about, explore, discuss the topic, and define new concepts based on the continuous discussion. It is in the same vein as constructivism in that it creates new knowledge by reaching a stage of broad and in-depth understanding of a presented topic through continuous discussion from various participant opinions (Mbatia, 2013). It is also related to social context and knowledge construction in that knowledge is acquired through continuous interaction with peers (Xia et al., 2013). For group projects, one of the representative activities of peer interaction, it is challenging to schedule the time of multiple students and to set an online meeting place (Mensch & Ali, 2007). In contrast, the asynchronous structure of the discussion board provides students with enough time to organize their thoughts and, at the same time, allows them to freely access and upload their own posts at a convenient time (Aloni & Harrington, 2018). In other words, the asynchronous online discussion board enables students to freely engage in discussion activities at their convenience, regardless of time and place.

Blogs have attracted the attention of many scholars and practitioners because of their advantages of the permanent storage of posts (Thiyagu, 2013; Zhang, 2009). However, since all students post separately on their own blogs, they have to go through the pain of clicking every blog link to visit their peers' sites to read their posts. Students may need to create an unnecessary account to view the posts. Unlike blogs, a discussion board is one of the default features of the LMS, such as Canvas or Google Classroom. Therefore, there is no need to purchase a separate online discussion service or create a blog service account. Instructors can also create multiple discussion boards in one course and use them for a variety of purposes. That is, a large number of students can be formed into small groups to conduct a discussion

session at the same time. As such, the discussion board is a basic tool that supports peer interaction asynchronously online and is a convenient and easy way to apply various instructional strategies to promote peer interaction.

Despite these many benefits, the prior studies on peer interaction through discussion boards have shown many negative results (Aloni & Harrington, 2018; Delaney et al., 2019; Lesht & Schejbal, 2020; Moore et al., 2016). Based on previous research, four challenges related to the negative consequences of online discussion board use were summarized: (1) no clear guidelines for the use of discussion boards, such as purpose, basic rules, and expected actions, (2) poorly designed board structure without considering features such as an adequate number of posts, timely feedback, and monitoring, (3) lack of instructional strategies that promote motivating participation, such as a sense of belonging, collaboration, and ownership, and (4) lack of instructor involvement that guides, facilitates and monitors peer interaction (Aloni & Harrington, 2018; Croxton, 2014; de Lima et al., 2019; Lesht & Schejbal, 2020; Xia et al., 2013).

Research Framework

Theoretical Framework: Sociocultural Perspective

Sociocultural scholars view knowledge as participation in a particular community of practice, so learning is defined as the process of reinforcing this sense of belonging, participation, or communication (Berliner & Calfee, 1996; Freeman, 2010; Sfard, 1998; Vygotsky & Cole, 1978). Learning is also a social process created and infused by cultural meaning (National Academies of Sciences, Engineering, and Medicine, 2018). Unlike the cognitive view, which sees learning as an individual process of acquiring the commodity of knowledge (Kubat, 2018; Morris, 2019), this sociocultural perspective sees learning as a social process of becoming

an expert in the community with the instruction and guidance of experts (Berliner & Calfee, 1996; Sfard, 1998). More specifically, learning refers to a process in which a novice learner participates in the community's activities as a peripheral person but becomes increasingly skilled with the guidance and help of experts and becomes the center of the community (Lave & Wenger, 1991, as cited in Berliner & Calfee, 1996). This view considers that a novice learner's peripheral participation and apprenticeship in the community of practice are essential concepts (Berliner & Calfee, 1996).

Learning can only occur when an individual participates in a learning community as a periphery person, and this learning community should provide an environment where a novice learner can grow as an expert by observing and practicing with experts or skilled peers (Berliner & Calfee 1996). In other words, interactions with external factors containing experts or experienced peers affect an individual's learning process significantly. This perspective is quite different from the cognitive viewpoint that the structure and function of the human brain influence an individual's learning process and outcomes (Glaser, 1984; Kirschner et al., 2006).

For effective apprenticeship-based learning, culturally and socially mediated learning activities are required in addition to human interaction (Vygotsky & Cole, 1978, as cited in Motlhaka, 2020). Writing activities based on collaborative practice facilitate mediated learning and learning negotiation, and the use of technology-assisted discussion boards can provide interactive and collaborative practice in various learning environments (Motlhaka, 2020).

Students participate in weekly learning community small group discussions in a given discussion board activity, performing a series of tasks based on their assigned role. Students will become experts in small group discussions while carrying out steady discussion work during the

semester. In this learning community, students naturally create their own posts by carefully reading the guidelines, observing peers' good posts, and imitating provided good posts. These collaborative discussions make writing (posts) a form of social action and a tool for communication among students in an online environment (Fletcher & Bullock, 2015; Motlhaka, 2020).

Collaborative written activities in a small online group can promote student engagement by allowing students to share their ideas and feedback with other people (Motlhaka, 2020). Assigning different roles to individual group members can encourage students to develop a sense of ownership and responsibility for their groups, further facilitating individual students to be the center of the learning community (Lesht & Schejbal, 2020; Yilmaz & Yilmaz, 2019). For example, a moderator student provides clear direction for a given discussion and motivates group students to actively participate in the discussion through additional questions or prompts. In the absence of a post, a moderator can also engage peers by posting questions that promote their interest, such as "What do you think is the social impact of BTS, famous Korean boy group?" In this way, students will become the center of the learning community by fulfilling their assigned roles (Hara et al., 1998) and reflecting on learning from a sociocultural perspective (Bonk & King, 1998b).

Instructional Strategy: Guided and Role-based Discussion in a Small Group

The root cause of students' negative feedback on using discussion boards for peer interaction was that they did not experience the educational effect of discussion learning activities compared to the time and effort they committed. Some students stated discussion board activities as a waste of time, emphasizing that uploading posts to the discussion boards

was the evidence of doing assignments, not authentic interactions. One student complained, "well, for most cases, it is a poor use of discussion boards. On the contrary, some researchers reported that providing a clear guideline about discussion activities helps encourage discussion and help save time in understanding and joining the discussion activity (Lesht & Schejbal, 2020; Yilmaz & Yilmaz, 2019).

Based on a literature review of issues associated with the use of discussion boards for peer interaction, three critical aspects have been derived: (1) providing clear guidelines and instructions about the provided discussion activity, (2) assigning students to small groups, and (3) assigning different roles to the individual members within a group.

Inadequate discussion board structure and lack of guidance for discussion activities were the most cited challenges experienced by students when interacting with peers through discussion boards (Lesht & Schejbal, 2020; Xia et al., 2013). Therefore, the discussion board design method proposed in this study will include clear guidelines and guidelines. The explicit and structured guidelines can help students actively participate in the provided discussion by clearly indicating what this discussion is about, what rules to follow, and what tasks to do in the provided activity (Aghaee & Keller, 2016; Lesht & Schejbal, 2020; Xia et al., 2013). Appropriate guidance leads to meaningful interactions among students by supporting them to share their opinions and information, to create new knowledge together, to recall learning, and to avoid distracting from the topic (Aghaee & Keller, 2016; de Lima et al., 2019; Lesht & Schejbal, 2020; Song & McNary, 2011; Yilmaz & Yilmaz, 2019). An overview of the discussion activity, rules to be followed, tasks to be performed, group formation, and role assignment should be described before starting the first discussion session; notably, all students must comply with these rules

and roles (Yilmaz & Yilmaz, 2019). Providing example posts and detailed instructions on how to write a post will save students time understanding how to write a proper post, helping them quickly adapt to online conversational activities.

It was also pointed out that students had to spend much time reading and commenting on all the posts because of many posts and discussion threads on the discussion (Lesht & Schejbal, 2020; Moore et al., 2016). Like a student's suggestion, "they were broken up into small groups and the members rotated and that was nice ..." (Lesht & Schejbal, 2020, p.7); this problem can be solved by limiting the maximum number of words per post and assigning students to small groups. It was also found that the smaller the group size, the higher the efficiency of collaborative learning (Tenenbaum et al., 2020). Students in small groups can fully read and understand their peers' posts and comment on them, enabling them to focus more on ongoing conversations and further promoting meaningful interactions between student (Croxtton, 2014; Lesht & Schejbal, 2020; Webb et al., 1995).

Role-playing is an instructional strategy that allows students to share their previous knowledge, learn about the presented topic with others, and construct new knowledge in a simulated setting (Hou, 2012; Wise & Chiu, 2011). Students can gain "ownership" of the learning process by giving their opinions based on their own experiences on a given topic or situation in terms of their assigned roles and actively participating in discussions (Hou, 2012; Wise & Chiu, 2011). In addition, role-based discussion can improve students' problem-solving skills by assigning students to different roles in each session and allowing them to solve problems or situations independently according to the assigned roles (Bonk & Sugar, 1998; Hou, 2012; Lesht & Schejbal, 2020). Roles can provide clear guidance on expected tasks,

responsibilities, and behaviors in discussion groups (Wise & Chiu, 2011; Yilmaz & Yilmaz, 2019). Also, roles can promote collaborative knowledge construction by requiring different contributions based on the assigned roles for knowledge creation in a discussion group (Wise & Chiu, 2011; Yilmaz & Yilmaz, 2019). Each role within an online group performs a different task and impacts knowledge creation and interactions (Wise & Chiu, 2011; Wise et al., 2012).

In this proposed instructional strategy, the final roles were adopted and modified based on the roles and seven essential conversational functions in Table 2 by Wise et al. (2012) and Gu et al. (2015) 's role structure. Four roles were created to avoid overlapping the seven types of conversational features: (1) moderator, (2) supporter, (3) challenger, and (4) summarizer.

A moderator provides clear direction for a given discussion and motivates people to actively participate in the discussion through additional questions or prompts (motivate and give direction). A moderator also guides students to respect each other, use appropriate language, and be polite during discussions. In this proposed instructional strategy, the role of the responder was divided into positive (supporter) and negative (challenger) to promote students' critical thinking, negotiation, and integrating skills. The supporter replies to all the posts and comments from the positive view and uses a new idea or related theory (respond to the posts, bring in new ideas, and use theory). The challenger does the same task as the supporter, but this role only gives negative perspectives on all the posts or comments (respond to the posts, bring in new ideas, and use theory). Lastly, a summarizer wraps the entire discussion session every week to summarize all the essential key concepts, theories, and conclusions the group draws (summarize). Additionally, the summarizer brings in a new source

(bring in source) and provides a brief summary to every discussion thread to help students better understand the ongoing discussion.

Table 2

The Combination of a Role Name and the Functions to Serve in a Group by Wise et al. (2012)

	Motivate	Give direction	Bring in new ideas	Bring in sources	Use theory	Respond	Summarize
Moderator	X	X	X			X	X
Starter		X	X				
Topic Leader		X	X				
Wrapper							X
Topic Reviewer							X
Summarizer							X
Integrator		X					X
Responder		X				X	
Alternative Developer			X				
Theoretician					X		
Source Searcher				X			

In this study, students were divided into small groups and assigned different roles to each member of the group, which promotes student accountability and participation in discussion and supports a collaborative learning environment. A new role was assigned to individual students each week, and after all students in the group had experienced all the roles, that is, after four weeks, students were re-assigned to the new group. In this way, all students could experience different discussion sessions in different roles with more peers on different topics.

Chapter 3: Methods

Study Design

As shown in Table 1, this study utilized a mixed methods design to collect quantitative and qualitative data to answer the two research questions developed (Cameron, 2009; Creswell & Plano-Clark, 2017; Zhu & Bonk, 2019; Zhu, 2022). In particular, this study used the explanatory sequential mixed method approach, which gathers quantitative data on the same learning activities of students first, then collects qualitative data, and connects the two data for analysis (Cameron, 2009; Zhu & Bonk, 2019; Zhu, 2022). Four data sources were used: (1) online surveys, (2) semi-structured individual interviews, (3) online discussion board posts, and (4) online discussion board logs. To increase the survey response rate, all students enrolled in the target course were sent a link to the online survey starting from Week 13. Based on the weekly collection of student posts, system logs, and some online survey responses collected from week 13, the lead researcher made minor adjustments to the discussion activity design. During Weeks 14 and 15, the group size was increased from 4 to 8 (or 5 to 9), and only the moderator and summarizer roles were assigned to two students each. Using the results of quantitative data analysis of online survey responses and online discussion board logs collected at the beginning, individual interview questions were enhanced and improved while others were added to more deeply understand student perceptions. The results of this quantitative data analysis were also used as a reference for analyzing students' posts uploaded on the weekly discussion board. Qualitative data, such as individual interviews and discussion posts, could provide a complementary perspective to quantitative data, helping to explain data findings and enhance understanding of the same phenomenon from different angles (Cameron, 2009; Zhu &

Bonk, 2019; Zhu, 2022). This approach, known as data triangulation, involves collecting multiple data using hybrid methods at different stages of the study (Cameron, 2009; Zhu & Bonk, 2019).

Course Design

This study was conducted at the IST department at Indiana University Bloomington, which offers several online courses. Implementing the redesigned online discussion board into the course required the support and cooperation of instructors. The instructors of the online course were recruited as supporters of this study, and students enrolled in the selected course were asked to participate in this study.

The target courses of the proposed study should meet the following requirements: (1) fully online, (2) graduate-level offered by the IST department, and (3) lecture or seminar type (focusing on theory). Based on these requirements, three courses from the Fall 2022 course list, *R511: Instructional and Performance Technologies Foundations*, *R622: Learning Environments Design*, and *R711: Readings in Instructional Technology*, were selected, and the study participation invitation e-mails were sent to the instructors in charge of these courses at the end of July. One instructor did not respond, and the other instructor declined to participate in this study because she already had a plan for her course. So, finally, only one course, *R622: Learning Environments Design*, was decided as the target online course for this study.

The target course, *R622: Learning Environments Design*, aims to help students learn about various learning theories and environments and design their own learning environments based on what they learn in class. Therefore, a sufficient understanding of the learning materials provided is essential for the successful completion of the learning environment design major project. The instructor in charge in this course agreed to use online discussion format for

helping students learn. As a result, the lead researcher and the instructor re-designed the traditional online discussion board provided by Canvas, one of the popular Learning Management Systems (LMS) by implementing three instructional strategies, (1) guided instruction, (2) role-based discussion, and (3) small group discussion.

Table 3

Discussion Topic List per Week

Week	Starting Date	Topic
1	8/22/2022	Learning Environments Foundations and History
2	8/29/2022	learning Theory and Learning Environments
3	9/05/2022	Formal K-12 Learning Environments
4	9/12/2022	Informal Learning Environments
5	9/19/2022	Learning Environments in the Workplace
6	9/26/2022	Authentic Learning Environments in Higher Education
7	10/03/2022	Active Learning Space in higher education
8	10/10/2022	Youth Participatory Action Research
9	10/17/2022	Wellbeing and Belongingness
10	10/24/2022	Mindfulness, Open Thinking, and Radical Creativity
11	10/31/2022	Technology-Enhanced Learning and Microlearning
12	11/07/2022	Designing Effective Online Learning Environments

13	11/14/2022	Smart Learning Environments
14	11/28/2022	AI, Robotics, and the Metaverse
15	12/05/2022	Trends and Issues

The concepts and theories related to learning environment design were reviewed, classified into 15 topics, and assigned to 15 weeks, and the list of weekly discussion topics was created and displayed in Table 3.

In this study, in order to increase student participation and responsibility every week, all students were assigned one of the following four roles: (1) moderator, (2) supporter, (3) challenger, and (4) summarizer to perform that role. A different role was assigned each week within the same group for four consecutive weeks, so all students in the group purposefully were designed to play all four roles. In particular, all students in the same group were originally assigned to play different roles, but the actual number of participants was 18 at the beginning of the semester, so two groups had four students (students A, B, C, D) and the other two groups had five students (students A, B, C, D, E). To reduce the number of cases in which groups of five students play the same role, two types of role formation tables were used, as shown in Figure 1. The group and role assignments for the entire 15 weeks were planned and distributed to the students before the course started to support students to prepare their roles in advance, as shown in Figure 2. However, in the 9th week, one student dropped out of this course due to personal reason, so the role/group assignment table after the 10th week was slightly modified.

Week	Roles			
	Moderator	Supporter	Summarizer	Challenger
1	AE	B	C	D
2	B	CD	E	A
3	C	A	BD	E
4	D	E	A	BC

(a) For five students

Week	Roles			
	Moderator	Supporter	Summarizer	Challenger
1	A	B	C	D
2	D	A	B	C
3	C	D	A	B
4	B	C	D	A

(b) For four students

Figure 1. Role formation rule for four weeks

Rules regarding online discussion board activities, rules about discussion post-writing, good and bad examples of a discussion post, definitions of four roles, tasks for each role, and examples of good posts according to each role were written into a single guideline document (see Appendix F). This guideline document was distributed to all enrolled students prior to the start of the course to enable them to have sufficient time to familiarize themselves with the new format of online discussion learning activities. Group formation and role assignments for

the entire 15 weeks were written in a single Google spreadsheet, and the link was also distributed when distributing the guideline document (see Figure 2). In addition, the syllabus provided in advance included the start date, discussion topics, and relevant reading list information for each week, corresponding to a total of 15 weeks. As such, students were informed of all information regarding the online discussion board learning activities prior to the start of the course.

Group/role assignment (Week 2 - Week 5)					Group/role assignment (Week 6 - Week 9)				
Week	Group	Name	Role	RoleID	Week	Group	Name	Role	RoleID
2	Session1A	Student1	Moderator	MOD	6	Session2A	Student10	Moderator	MOD
	Session1A	Student2	Supporter	SUP		Session2A	Student4	Supporter	SUP
	Session1A	Student3	Summarizer	SUM		Session2A	Student3	Summarizer	SUM
	Session1A	Student4	Challenger	CHA		Session2A	Student9	Challenger	CHA
	Session1A	Student5	Moderator	MOD		Session2A	Student15	Moderator	MOD
	Session1B	Student6	Moderator	MOD		Session2B	Student2	Moderator	MOD
	Session1B	Student7	Supporter	SUP		Session2B	Student14	Supporter	SUP
	Session1B	Student8	Summarizer	SUM		Session2B	Student8	Summarizer	SUM
	Session1B	Student9	Challenger	CHA		Session2B	Student7	Challenger	CHA
	Session1B	Student10	Moderator	MOD		Session2B	Student1	Moderator	MOD
	Session1C	Student11	Moderator	MOD		Session2C	Student13	Moderator	MOD
	Session1C	Student12	Supporter	SUP		Session2C	Student18	Supporter	SUP
	Session1C	Student13	Summarizer	SUM		Session2C	Student12	Summarizer	SUM
	Session1C	Student14	Challenger	CHA		Session2C	Student6	Challenger	CHA
	Session1D	Student15	Moderator	MOD		Session2D	Student11	Moderator	MOD
	Session1D	Student16	Supporter	SUP		Session2D	Student17	Supporter	SUP
	Session1D	Student17	Summarizer	SUM		Session2D	Student16	Summarizer	SUM
	Session1D	Student18	Challenger	CHA		Session2D	Student5	Challenger	CHA
Session1A	Student1	Challenger	CHA	Session2A	Student10	Challenger	CHA		
Session1A	Student2	Moderator	MOD	Session2A	Student4	Moderator	MOD		
Session1A	Student3	Supporter	SUP	Session2A	Student3	Supporter	SUP		
Session1A	Student4	Summarizer	SUM	Session2A	Student9	Summarizer	SUM		
Session1A	Student5	Supporter	SUP	Session2A	Student15	Supporter	SUP		
Session1B	Student6	Challenger	CHA	Session2B	Student2	Challenger	CHA		
Session1B	Student7	Moderator	MOD	Session2B	Student14	Moderator	MOD		
Session1B	Student8	Supporter	SUP	Session2B	Student8	Supporter	SUP		
Session1B	Student9	Summarizer	SUM	Session2B	Student7	Summarizer	SUM		
Session1B	Student10	Supporter	SUP	Session2B	Student1	Supporter	SUP		
Session1C	Student11	Supporter	SUP	Session2C	Student13	Supporter	SUP		
Session1C	Student12	Summarizer	SUM	Session2C	Student18	Summarizer	SUM		
Session1C	Student13	Challenger	CHA	Session2C	Student12	Challenger	CHA		

Figure 2. Group and role assignment table

Researcher Role

The lead researcher, who also served as Teaching Assistant (TA) for the target course, worked with the instructor to design and support an online discussion board learning activity

with three instructional strategies. During the 15-week course period, the lead researcher actively supported group and individual students' discussion activities by sending out weekly reminders for role and group assignment information and conducting daily monitoring of small group channels. The lead researcher tried not to participate in discussions unless there were obstacles or problems that hindered the progress of the discussion within the group.

Participants

This study recruited 18 participants using purposive sampling. This is because purposive sampling helps better to match the sample to the purpose of the study, increasing the reliability of the data and results (Campbell et al., 2020). After receiving IRB approval (IRB Protocol #15787) and the IST department coordinator's permission, separate study invitation emails (see Appendix B) were sent to only instructors who have the potential to use the online discussion board among the courses to be opened in the Fall of 2022. Students enrolled in the course of the instructors who have expressed their intention to participate were invited to this course as target participants. At least two courses were attempted to be recruited, but only one final course was selected due to the limitations of the provided courses.

More specifically, the instructor of the selected course participated in this study as an instructional designer and supporter. The participating instructor and lead researcher worked together to design a discussion board activity that fits the topic of the course. The instructions, guidelines, and good and bad examples of posts relevant to the topic of the target courses were written and reviewed by the respective instructor and researcher. In particular, prior collaboration with the instructor helped him become aware of and fulfill their roles of reviewing

group composition, assigning roles within the group, assigning necessary tasks to each role, and monitoring group discussions on a regular basis.

Evaluation Factors

In this study, peer interaction and student discussion activity satisfaction were examined to find out whether guided, role-based, and small group instructional strategies applied to an online discussion board facilitate interaction among students.

Peer Interaction

Peer interactions were examined based on data from online surveys, semi-structured interviews, discussion board observation, and system data. The peer interaction online survey questions for this study were adopted and modified from Sher's (2009) questions. In this study, "course" was replaced with "discussion board," and all questions were reviewed and revised to meet the purpose of this study. As Table 4 shows, the finalized seven questions explored students' perceptions of interacting with peers using the provided asynchronous online discussion board. The participating students responded to the questions provided on a 5-point Likert scale ranging from 5 (strongly agree) to 1 (strongly disagree).

Table 4

Peer Interaction Variable and Questions

Variable	Questions
Peer Interaction	1. I was able to communicate with peers in this discussion board.
	2. I was able to share my opinions/views/thoughts with peers in this discussion board.

	3. I was able to clearly read and understand peers' posts in this discussion board.
	4. I was able to organize my thoughts and leave a comment after reading peers' posts in this discussion board.
	5. Conversations/discussions with peers helped me better understand the given topic/problem/prompt in this discussion board.
	6. I think there was a sense of community with peers using this discussion board.
	7. This discussion board encouraged me to actively participate in the discussion.

Individual semi-structured interviews were conducted to further understand students' perceptions of peer interactions in designed discussion board activity. In an online survey, students were asked whether they would like to participate in a semi-structural individual interview via Zoom, one of the most popular online conference tools. To increase participation in the interview, an Amazon gift card worth \$20 was given to everyone who participated in individual interviews, which was also announced in the online survey. Among the students participating in the study, a total of 14 students voluntarily participated in a semi-structured individual interview. The interview questions on peer interaction were mainly presented in an open-ended format, with the main and additional questions as follows (see Appendix C) to ensure honest responses from participating students.

Main questions:

- What did you like about interacting with your peers (classmates) in the provided discussion activity? And why?
- What was the most challenging part of interacting with your peers (classmates) in the provided discussion activity? And why?
- What would you suggest as a way to improve peer interaction on the provided discussion board? And why?

Additional questions:

- Do you think peer interaction is necessary in online learning? The reason is that? If not needed, why?
- If you think peer interaction is beneficial to learning, what is the best tool or approach to support peer interaction in online course?

To ensure that students were actually interacting on the discussion boards, the study analyzed online discussion board system data as well. The lead researcher utilized the student posts saved on the asynchronous online discussion board to calculate multiple factors, such as the number of posts, consistency of post-uploads, peers interacted with, and posts per conversation thread per week. A reference table, presented as Table 5, was prepared based on the framework of Nandi and Chang (2009) to assess the quality of interactions in an asynchronous online discussion forum. The number of students who commented on each post per week and the number of posts attached to a single conversation thread were also counted. Each criterion was rated on a scale from 4 (excellent) to 1 (poor), as indicated in Table 5. The

calculated criteria were used to assess whether students communicated with their peers during the one-week discussion period.

Table 5

Conceptual Framework for Assessing Quality in Asynchronous Online Discussion (Nandi & Chang, 2009)

	Criterion	Poor (1)	Satisfaction (2)	Good (3)	Excellent (4)
Observational data per week	Participation rates (the number of uploading posts)	None or less than 2 posts	Between 2 to 4 posts	Between 5 to 7 posts	More than 8 posts
	Consistency of participation (the number of days posted)	Post just 1 day	Post in 2 days	Post in 3 days	Post in more than 4 days
	Number of students per conversational thread	Only 1 person	2 people	3 people	More than 4 people
	Number of posts per one	Only 1 post	2 posts	Between 3 to 4 posts	More than 5 posts

	conversational thread				
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The quantitative data mentioned above served as a basis for demonstrating whether student interaction occurred on the proposed asynchronous online discussion board. However, it was not sure to ascertain whether the students' interactions were genuine or whether meaningful conversations about the presented topics actually took place. Therefore, it was necessary to investigate whether authentic interactions occurred between students. This study aimed to find out whether students shared their thoughts on a given topic with their peers using the provided discussion board rather than simple conversations or small talk between students. Therefore, in order to investigate authentic or meaningful interactions between students, it was necessary to define precisely what it means in this study.

The term 'authentic' is defined in the dictionary as genuine and real (Merriam-Webster's Collegiate Dictionary, n.d.). However, its interpretation can vary depending on the context in which it is applied. Scholars have employed and defined the term 'authentic' differently based on the specific context they study. For instance, Lebow (1993) utilized the term 'authentic' to describe learning activities that involve individuals' experience of practicing skills in a setting like the environment in which it will be used. In another study, 'authentic' was defined as the real-world experiences people encounter in various social contexts including home, work, or school (Newmann & Wehlage, 1993).

This study defined 'authentic' as genuinely performing the required tasks for each role in discussion activities. In other words, according to the given role, it was evaluated that authentic

interaction occurred in posts that clearly explained their opinions on a specific issue or topic and presented appropriate evidence to support their position. Authentic interactions also included expressions of support or disapproval of another peers' posts while providing evidence or examples to support the student's statement. In this study, it was considered meaningless to use simple phrases such as 'good,' 'agree,' 'excellent,' and 'disagree' about other students' posts.

Roles were assigned to all students in small groups to promote student participation, responsibility, and ownership in this study. In particular, it was promoted to increase the contribution of each student by minimizing the duplication of students' roles within the same group. Each role was assigned specific tasks to facilitate group discussion (see Appendix D). Within the group, students performed their assigned roles on the problems presented. Therefore, meaningful interaction in this study means that students perform the required tasks well according to the guidelines provided during the one-week discussion period. Each week the posts uploaded by students were evaluated according to their assigned roles.

The rating level for each role was adopted and modified from Gu et al. (2015)'s rating levels for specific roles. Each post uploaded by students to the discussion board was rated on a 4-point scale from 0 (lowest) to 3 (highest), as shown in Table 6. This scale served as evidence of whether students have performed well on a task according to their assigned role, while at the same time serving as data indicating whether a qualitative (real) interaction has occurred. Since each student was given the task required in the discussion activity, it can be inferred that authentic discussion activity (interaction) was achieved when this role was performed well. In this study, four roles are provided: moderator, supporter, challenger, and summarizer. As

shown in Table 6, the code from 1 to 4 will be respectively assigned to a (1) moderator, (2) supporter, (3) challenger, and (4) summarizer for supporting convenient coding. A level from 0 to 3 was assigned to each post according to the rating levels of Table 6. This combination of code and level were convenient when analyzing the quality of the collected discussion posts. All types of posts with unrelated content and undesirable content were rated 0.

Table 6

Rating Levels of Particular Role

Role	Description	Role index	Rating Level
Moderator	No topic/prompt introduction	1	0
	No guide questions provided	1	0
	No guideline/direction provided	1	0
	No monitoring	1	0
	Provide a brief direction, but it is not clear	1	1
	Post only questions/topics/prompts without detailed explanation	1	1
	Post only a short message to encourage participation	1	1
	Briefly mention peers who are not participating in the discussion	1	1
	Simply answer (Yes or No) to students' questions or help	1	1

Not enough details, but provides clear direction	1	2
Provide questions, ideas, topics, or prompts with the short explanations	1	2
Encourage peers to engage in discussion by calling their names and asking questions	1	2
Identify and share the cause of the conversation progress bottleneck	1	2
Answer students' questions or help students, but it takes time (more than 24 hours)	1	2
Facilitate discussion with appropriate feedback on student posts	1	3
Provide a clear direction with sufficient details	1	3
Address the questions, ideas, topics, or prompts with clarifications and lead further questions	1	3
Identify and share the cause of the conversation progress bottleneck, and provide the possible solutions	1	3
Facilitate the discussion by responding appropriately to the peers' responses or by asking relevant additional questions	1	3

	Provide timely feedback to students who post questions or need help	1	3
Supporter	No response to the post	2	0
	No posts supporting post comments	2	0
	Simply agree to the post without supporting details	2	1
	Present compliments on the post without sufficient explanation	2	1
	Demonstrate agreement on the post, but the supporting evidence are lacking	2	2
	Express compliments on the post, but reasons are not reasonable (or not make sense)	2	2
	Demonstrate agreement on the post with sufficient evidence	2	3
	Express compliments on the post with reasonable reasons	2	3
	Demonstrate agreement on the post by posing advanced or provoking questions	2	3
	Encourage peers to think critically by asking new questions	2	3
	Express agreement on the post by analyzing and comparing different statement	2	3
Challenger	No response to the post	3	0

No sharing post with challenging questions	3	0
Simply demonstrate disagreement on the post without supporting details or reasons	3	1
Simply express criticism on the post without supporting details or reasons	3	1
Demonstrate disagreement on the post, but supporting details are lacking	3	2
Express a negative view or opposite opinion on the post, but sufficient evidence is lacking	3	2
Present the interesting or fresh view on the post, but the supporting details are not reasonable	3	2
Demonstrate disagreement on the post with supporting details	3	3
Express a negative view or opposite opinion on the post with sufficient evidence	3	3
Present doubts by providing logical/reasonable arguments	3	3
Demonstrate doubts by asking new questions	3	3
Agree on a few points, dispute an argument with supporting details or ask a new question	3	3
Encourage peers to think critically by asking new questions	3	3

Summarizer	No summary	4	0
	No wrap-up the week	4	0
	No drawing a conclusion	4	0
	Summarize by simply repeating the similar expression used in the other posts	4	1
	Simply mention the ending of the discussion week	4	1
	Address a conclusion without supporting details	4	1
	Share a new source by posting a new source link or document file	4	1
	Summarize one conversational thread, but lack of evidence or details	4	2
	Briefly summarize the content of the week's discussion, but the details are still lacking	4	2
	Share with a brief mention of new sources, but the explanation is insufficient or meaningless	4	2
	Present the conclusion, but supporting points are lacking	4	2
	Present a discussion thread with sufficient evidence, summarizing its own words	4	3
	Provide well organized summary of the week in its own words	4	3

	Provide one-week conclusions based on sufficient evidence	4	3
	A concise description of the relationship to the topic being discussed, along with a clear reason for bringing in a new source	4	3
	Helping peers better understand by providing additional sources with references	4	3
	Present the well-organized summary of one thread in right place to help people to move to the next thread	4	3
Responder (Answerer)	No response	5	0
	Simply mention the answer to the provided questions	5	1
	Simply share the answer to peers' post	5	1
	Present the answer to the provided questions, but the supporting details are still lacking	5	2
	Share the answer to peers' posts, but the supporting details are still lacking	5	2
	Present the answer to the provided questions with sufficient details	5	3
	Share the answer to peers' posts with sufficient details	5	3

	Promote peers to engage by asking new questions while providing answers to questions provided	5	3
	Help peers to understand by answering a given question, summarizing someone else's post, or presenting actual examples	5	3
General (applied to all posts)	Present content unrelated to a given topic	6	0
	Post the content that contains profanity, gossip, or inappropriate words or expressions	6	0
	Share the plan for posting	6	1
	A simple expression of thanks or a good job	6	1
	A simple answer to peers' questions related to the discussion	6	1

Student Satisfaction on Discussion Activity

One of the widely used indicators of successful learning in online learning is the positive feedback from students who have participated in learning, which is called student satisfaction (Katsarou & Chatzipanagiotou, 2021). Student satisfaction can be described as a subjective perception or evaluation of outcomes and experiences related to educational services provided by an educational institution or educator (Gruber et al., 2010; Han et al., 2018; Katsarou & Chatzipanagiotou, 2021; Van Deuren & Lhaden, 2017). In particular, in a non-face-to-face online learning environment, unlike the method of receiving learning content from a teacher in a

traditional classroom-centered environment, students are asked to explore and find learning content on their own and actively participate in learning. Therefore, how students perceived and accepted the provided online discussion activities were among the crucial measures that potentially indicated the effectiveness of that offered learning. In this study, the feedback of participating students on the newly designed asynchronous online discussion board was collected and analyzed via two data sources. As shown in Table 1, the two data sources were an online survey and semi-structured individual interviews.

The online survey questions regarding student satisfaction with online discussion activity were adopted and modified from Sher's (2009) student satisfaction variables, as shown in Table 7.

Table 7

Discussion Activity Student Satisfaction Variable (Sher, 2009)

Variable	Questions
Discussion Activity Satisfaction	1. I was satisfied with this discussion activity.
	2. I think the quality of this discussion activity was good.
	3. I gained more interest in the topic of this discussion activity.
	4. I feel that this discussion activity served my needs well.
	5. I would like to participate in the similar discussion activity in the future.
	6. I would like to recommend this discussion activity to another student.

The interview questions associated with student satisfaction on discussion activity were presented in an open-ended format as follows with main and advanced questions (refer to Appendix C).

Main questions:

- What did you like about the provided discussion activity? And why?
- What was the most challenging part of the provided discussion activity? And why?
- What would you suggest regards to improving the provided discussion activity? For example, what would you change in this activity to make it more effective or engaged?

Advanced questions:

Three instructional strategies (guided, role-based, and small group) were applied to the provided online discussion board.

- Do you think that the application of the three instructional strategies was helpful for online discussion activities? If so, why? If not, why?
- As for guided instructional strategy, what worked well and didn't work?
 - What information do you think should be provided to guide students in online discussion board?
- As for role-based instructional strategy, what worked well and didn't work?
 - What roles would you assign for an effective online discussion? And why?
 - What role do you think is the most critical in online discussion? Why?
 - Which do you think is more effective, role assignment by an instructor or free role selection?
- As for small group instructional strategy, what worked well and didn't work?

- What do you think is the group size for an effective online discussion? Why?
- As for reading materials, how many articles do you think are appropriate for reading and discussing effectively in a week? Why?
- Do you think instructor's active involvement in online discussion is helpful? Why? If not, why?

Data Collection

This study collected four types of data, (1) online survey responses, (2) semi-structured individual interview transcripts, (3) online discussion board logs, and (4) online discussion board posts to seek answers to the research questions presented. Data triangulation was used to collect different types of data at different stages of the study, which improved reliability in data collection (Cameron, 2009; Zhu & Bonk, 2019). All identifiable data gathered during the course period was removed, and only text was used as data. In addition, all collected data was used only in an accumulated form and was stored in encrypted documents, accessible only to researchers and authorized internal personnel.

Data was collected for approximately four months from August 22, the start of the fall semester of 2022, to December 16, the date of the last individual interview.

Online Surveys

All online survey questions were developed using the online survey software, Qualtrics, to investigate students' perceptions of peer interactions occurring on the proposed discussion board and their satisfaction with discussion board learning activities (refer to Appendix A). The online survey consists of three parts: (1) recipient's basic information, (2) recipient's perception of peer interaction which occurred on the provided online discussion board, and (3) recipient's

satisfaction with the provided online discussion board activity. Questions related to basic information were written in multiple-choice format, and questions related to peer interaction and discussion board activities were written on a 5-Likert scale. Finally, one open-ended format was added to collect general feedback from students. It took approximately 10 minutes or less to complete this online survey.

An online survey link was sent to all students enrolled in the target course at Week 13. At this time, students were asked if they would like to participate in a semi-structured individual interview. To increase the response rate of the survey, after sending the first survey link on Nov 18, two reminders were sent to participants who did not complete the survey both on Nov 25 and Dec 2nd.

Semi-structured Individual Interviews

Semi-structured individual interviews were conducted to understand students' reflections on the provided online discussion board activity from multiple angles. The interview questions contain two parts: (1) an interviewee's reflection about the proposed discussion activity and (2) an interviewee's reflection about peer interaction that he/she experienced when discussing with their peers using the discussion board.

Semi-structured one-on-one interviews were conducted from November 30 to December 16 in 2022 at the convenience of the interviewees. The interview protocol (refer to Appendix C), which contains the overall process of interview and provided questions, consent form, and personalized Zoom (online conference software) link were sent to the target interviewees before the scheduled interview date. All interviews were video recorded with the consent of the interviewees. All interviews were conducted via Zoom and took a total of 604.9

minutes, from a minimum of 29.36 minutes to a maximum of 59.16 minutes. To appreciate the interviewees for their voluntary participation in a personal interview, a \$20 Amazon gift card was sent to all interviewees along with a thank-you email after the interview.

Online Discussion Board Logs

Canvas, used as the LMS for the course, provided the function to create and use multiple discussion channels at a time. As shown in Figure 3, multiple discussion group channels were created every week, and students participated in discussion activities by participating in their own group according to the guideline. To prevent false engagements that increase engagement by posting all of your posts at the end, we are limiting post uploading time on all channels. Also, despite the delay in participation due to personal circumstances, students were given a grace period of three days. Moderators were also recommended to upload posts three days before the start of Friday's weekly discussion. Access to post uploads was granted from three days before the start of the discussion to three days (Wednesday) after the start of the week.

Week 3 (9/5 - 9/11): Session1D group	0 15		
All Sections			
Last post at Sep 12, 12:25 AM			No longer available
Week3 (9/5 - 9/11): Session1C group	0 18		
All Sections			
Last post at Sep 12, 12:24 AM			No longer available
Week 3 (9/5 - 9/11): Session1B Group	0 18		
All Sections			
Last post at Sep 11, 11:39 PM			No longer available
Week 2 (8/29-9/4): Session1B Group	0 12		
All Sections			
Last post at Sep 5, 7:18 PM			No longer available
Week 2 (8/29-9/4): Session1A Group	0 35		
All Sections			
Last post at Sep 5, 5:50 PM			No longer available
Week 2 (8/29-9/4): Session1D Group	0 13		
All Sections			
Last post at Sep 5, 1:35 AM			No longer available
Week 2 (8/29-9/4): Session1C Group	0 18		
All Sections			
Last post at Sep 5, 12:04 AM			No longer available

Figure 3. Online discussion board logs

All posts and system data, such as date, group name, role information, and more, uploaded to each group channel shown in Figure 4 were collected together. Posts and comments stored on all discussion channels were gathered on a weekly basis and organized in Google Spreadsheet in Figure 5 for convenient data analysis. In particular, all collected posts were reviewed and rated based on the rubric provided in Table 6 and saved in the same Google Spreadsheet in Figure 5.

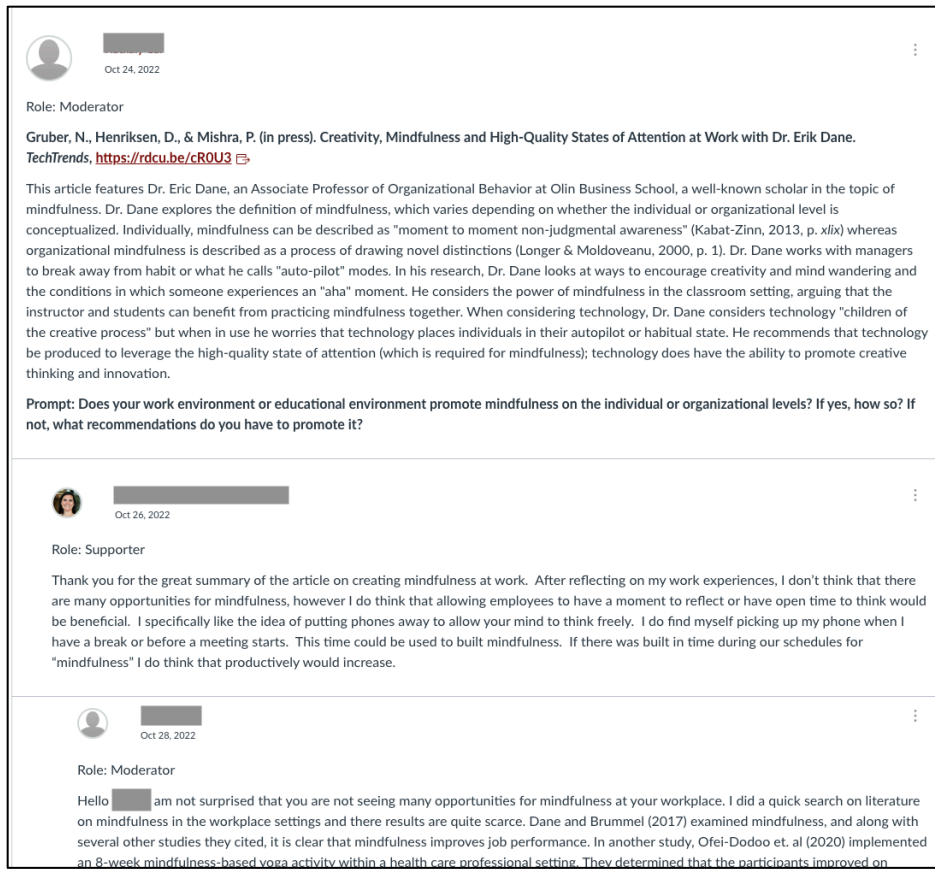


Figure 4. Inside view of a small group discussion channel

Week	Date	Group	Thread Index	Name Index	Assigned Role	Performed Role	Use new resources	Thread Index	Content	Rating Code	Row Rate
3	9/11/2022	Session1D	1	Student15	Supporter	Supporter		1	Hi [redacted]	2-3	3
3	9/7/2022	Session1D	1	Student15	Supporter	Responder	Yes	1	Hi Everyone,	5-3	3
3	9/10/2022	Session1D	1,2	Student16	Summarizer	Summarizer		1,2	Hi group! [redacted]	4-3	3
3	9/12/2022	Session1D	0	Instructor	(co) Instructor	General		0	Thanks for starting	6-0	0
4	9/12/2022	Session1A	1,2,3	Student3	Moderator	Moderator		1,2,3	Role: Moderator	1-3	3
4	9/13/2022	Session1A	2	Student4	Supporter	Responder	Yes	2	Role: Supporter	5-3	3
4	9/16/2022	Session1A	2	Student3	Moderator	Moderator		2	Role: Moderator	1-3	3
4	9/17/2022	Session1A	2	Student4	Supporter	Supporter	Yes	2	Hey [redacted]	2-3	3
4	9/17/2022	Session1A	2	Student3	Moderator	Moderator		2	I agree with you th	1-3	3
4	9/17/2022	Session1A	2	Student2	Challenger	Challenger		2	I really like the hun	3-3	3
4	9/17/2022	Session1A	2	Student4	Supporter	Responder	Yes	2	Hi [redacted]	5-3	3
4	9/17/2022	Session1A	2	Student2	Challenger	General		2	Thanks for followin	6-1	1
4	9/18/2022	Session1A	2	Instructor	(co) Instructor	Responder		2	Hey [redacted]..empl	2-0	0
4	9/20/2022	Session1A	2	Student4	Supporter	Responder		2	Hey [redacted]	5-2	2

Figure 5. All content of posts and logs

Online Discussion Board Posts

The lead researcher copied and saved all the contents of the automatically saved posts in the LMS to the spreadsheet shown in Figure 5 by the group every week. For privacy reasons,

all student names have been replaced with sequential names such as Student1, Student2, and Student18. At this time, the week information (i.e., Week 4), group information (i.e., Session1A), participant information (i.e., Student2), topic thread index (i.e., 1), assigned role (i.e., Supporter), played role (Responder), new resource introduction (i.e., Yes), actual post content, post rating code (i.e., 1-3), and actual rating score (i.e., 3) were saved.

Data Analysis

This study collected both quantitative and qualitative data from the four sources listed in Table 1. Quantitative data were obtained through online surveys and discussion board logs and analyzed using descriptive statistics. On the other hand, qualitative data was collected through online surveys, discussion board posts, and semi-structured individual interview scripts, after which content analysis was used to analyze this data.

Quantitative Data

Initial quantitative data was gathered through an online survey questionnaire. The survey consisted of 5-point Likert scale questions, and responses were analyzed using descriptive statistics such as frequency, percentage, mean, and standard deviation of SPSS (Zhu & Bonk, 2019). Analysis results were categorized into one of two parts: (1) peer interaction during asynchronous online discussions and (2) student satisfaction with the provided online discussion board activity. These findings were used to form the grounds for addressing two research questions.

Another quantitative data was obtained from online discussion board system. This study used the rubric displayed in Table 5 to calculate the number of posts, post-upload continuity, number of people per conversational thread, and number of posts per conversational thread on

a weekly basis. The first two variables were measured on a per-person basis, and the last two variables were evaluated on a per-discussion thread per week. Initially, the lead researcher determined a weekly mean scale for each variable. After the course was complete, the lead researcher calculated averages over 15 weeks to show the frequency and pattern of peer interactions over time using SPSS or Google Spreadsheet. This scale represents the frequency of peer interactions that occurred over a 15-week period and how this frequency changed over time.

Qualitative Data

Content analysis was performed to analyze the collected qualitative data, students' posts uploaded to the discussion board, and individual students' interview transcripts. Content analysis is a method in which many words in a text are reduced to a smaller number and organized into themes or categories using objective, systematic, and replicable techniques according to explicit coding rules (Prasad, 2008; Stemler, 2000).

The collected discussion posts could be analyzed faster than interview transcripts using pre-made codes, levels, and ratings (see Table 6). The lead researcher copied and saved all the posts in Google Spreadsheet shown in Figure 5 every week. The lead researcher analyzed the weekly saved posts according to the following steps.

1. Carefully read a discussion post.
2. Determine which topic thread the post corresponds to.
3. Determine what role the post was written by.
4. Locate the correct role code in Table 6.
5. Carefully read descriptions related to the determined role.

6. Decide the rating level

After the course was complete, the lead researcher reviewed again in detail the codes, levels, and ratings assigned to all students’ discussion posts.

Otter, an automatic audio transcription tool, was used to reduce the time and effort of transcribing the interview videos. Zoom videos of recorded interviewees were automatically converted into transcripts using Otter. At that time, to increase the accuracy of the transcripts, the lead researcher listened to the audio files one by one, compared the generated transcripts, corrected the wrong parts, and completed the final transcripts.

3. Sam’s Interview (41:22)

Free Code	Transcripts	Comments
	<p>(Peer interaction using discussion board)</p> <p>1. what did you like about interacting with your peers in this discussion, activity, and why?</p>	
Different insights	<p>0:16 Yeah, I think I think that's the main point. So, like, the main point is just, I enjoyed learning about the different insights, through their experiences, learning environments, that was really helpful going forward. Just I've been in different learning environments myself. So it was nice to have a discussion with others on what their experiences are from those different learning environments. But really, it comes down to just the Insight piece.</p>	
Different environment	<p>2. So what was the most challenging part of interacting with your peers in this activity?</p>	
Flow of the interaction	<p>0:56 Yeah, so I made a note of this I like, I think the most challenging part was the cadence flow, the cadence the flow of the interaction. Oftentimes, I found myself checking the discussion board often to see if people have responded, or if the moderators posted the summary of the required time. And when there weren't, or when it wasn't on time where the summary wasn't on time. It made it difficult for me to balance my time with the discussion and just stay</p>	
Difficult to balance my time with the flow of discussion		

Figure 6. Open-coding and vivo coding

The lead Researcher first carefully read the final interview transcripts without doing anything and then create a coding table with three columns, (1) open code, (2) raw transcripts, and (3) comments (see Figure 6). The lead researcher read each block of the transcript, wrote a key word, phrase, or sentence to demonstrate or summarize the paragraph, and continue the coding process until another researcher checked and confirmed all assigned codes. The developed codes were the combinations of open-coding and in-vivo coding. Open coding is an initial phase of data analysis and allows the researchers to add expressions or words to describe the assigned transcripts. In-vivo coding focuses on the actual transcripts, so researchers can recycle exact phrases or keywords to develop codes. After then, the researchers deleted some codes or combine some and created a new one while reading all codes considerably. Here are the criteria that were used when conducting the coding process.

- It is several times mentioned or said throughout the interview transcripts.
- The interviewee states that it is important, essential, helpful, or useful.
- It reminds the researchers of popular terms such as online, interactive, collaborative, learning or virtual, discussion boards, role-playing, and reflection.
- It is interesting or surprising.

At the end of the coding process, general themes for each question in the interview were derived.

Chapter 4: Results

Introduction

The purpose of this study was to explore if asynchronous discussion board learning activities that applied three popular instructional strategies, (1) guided instruction, (2) role-based discussion, and (3) small group discussion, could help facilitate peer interaction in an online graduate-level course. To examine the effectiveness of the proposed online discussion board learning activity, two evaluation factors, peer interaction and student satisfaction with the provided discussion board activity, were used. These evaluation factors were evaluated by collecting and analyzing four types of data: (1) online survey responses, (2) semi-structured individual interview transcripts, and (3) online discussion board logs and posts.

This study requires courses that meet the following three requirements. (1) completely online, (2) graduate level in an IST department, and (3) lecture or seminar type. Based on these requirements, three courses were selected from the Fall 2022 course list of the IST department. The lead researcher sent a study invitation email (refer to Appendix B) to three instructors, but only one course met all requirements, one instructor did not respond, and the other instructor declined to participate in this study. As a result, *R622: Design of Learning Environments* was chosen as the target course of this study. Since the sample size was small and only one course was studied, the results of this study are limited and not suitable for generalization. However, the results derived from this study can be used as an empirical example for designing asynchronous discussion activities to promote peer interaction in graduate online courses.

In this study, two research questions were developed to investigate whether an online discussion board activity applied with three instructional strategies had a positive effect on the

interaction among students: (1) how do students perceive online discussion board activities designed using guided, role-based, and small group instructional strategies? And (2) how do guided, role-based, and small group instructional strategies affect peer interaction in an online discussion board activity? To answer these research questions, four types of data were collected and analyzed: (1) online survey responses, (2) semi-structured individual interview transcripts, (3) online discussion board logs, and (4) online discussion board posts.

Online Survey

At 13th week, an online survey was sent to 17 participants, and 16 students responded. However, since one student did not complete the survey, only 15 responses were used as valid data for data analysis. The online survey consists of three sections: (1) participant biographical information, (2) participants' perceptions of peer interactions, and (3) participants' perceptions of online discussion board activity.

Participant Biographical Information

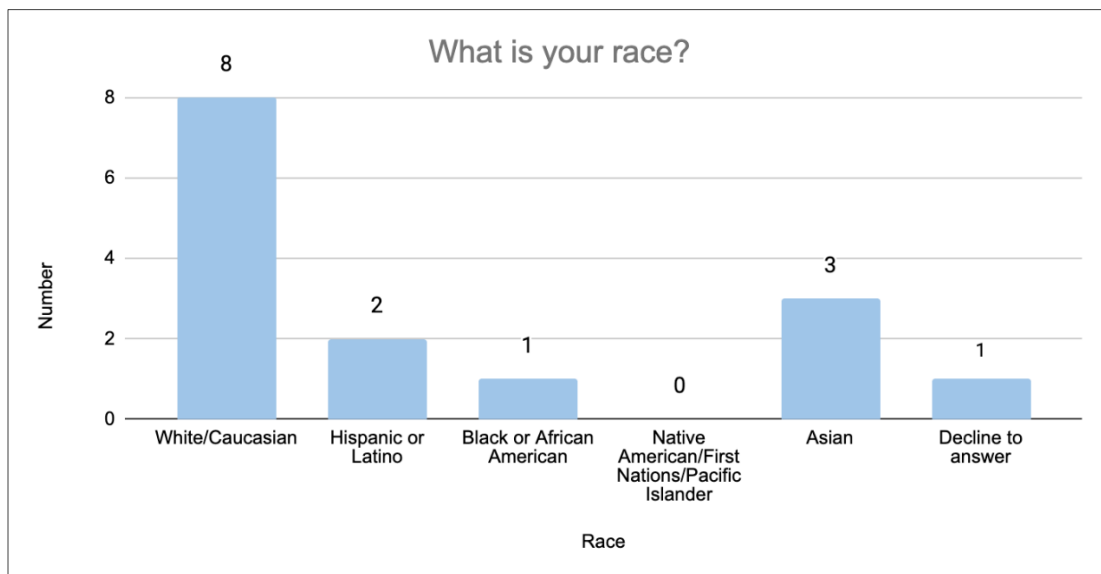


Figure 7. Races of participants

Seven male and eight female students participated in the online survey, showing a participation rate of 88.24%. By race, eight were White/Caucasian, three were Asian, two were Hispanic/Latino, one was African American, and one declined to answer (see Figure 7).

The participants majored in IST Ed. D-online (7), graduate certificate in IST-online (2), M.S.Ed. in IST -residential (1), M.S.Ed. in IST-online (1), M.S.Ed. in ETL-online (1), Ph.D. in IST-residential (1), and Ph.D. minor in IST-residential (1). Interestingly, all students who participated in the survey had full-time jobs.

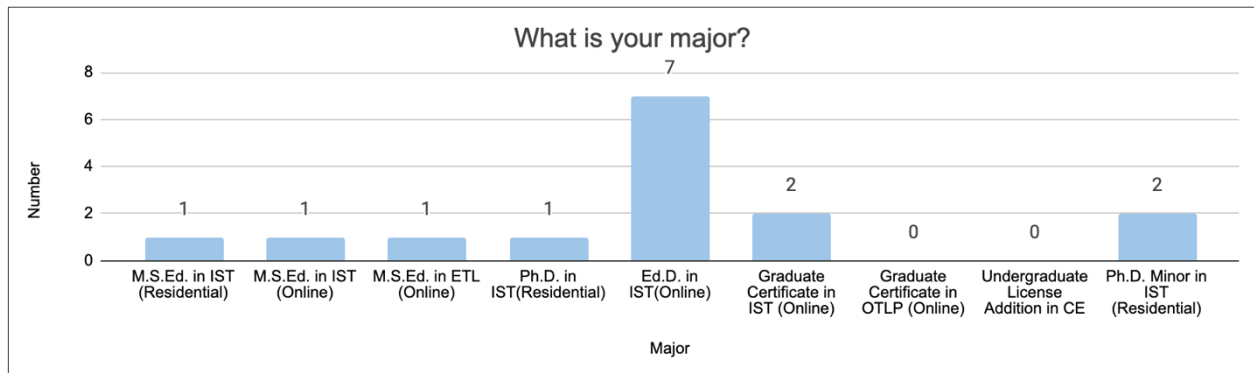


Figure 8. Majors of participants

Peer Interaction

To investigate students’ perceptions of peer interactions that occurred when using the provided online discussion board, a 5-point Likert scale with 5 strongly agree and 1 strongly disagree used (see Table 8). Students strongly agreed with the statement that an online discussion board was used to help them interact with peers, with a mean scale of 4.47. The interaction among students was analyzed and described in three parts: (1) sharing my opinion, (2) understanding the opinions of peers, and (3) understanding the opinions of peers and writing and presenting my opinions. The mean scale of each statement was 4.53, 4.40, and 4.47, respectively, and the students demonstrated positive responses about discussing the

given topic with their peers using the online discussion board. Students agreed with the statement that interaction with peers helps them understand a given topic (M = 4.07). Regarding the statement of whether interacting with peers using the discussion board was helpful in building a sense of community, students showed a neutral attitude with a mean score of 3.0. Finally, students were found to slightly agree with the statement that discussion boards facilitated students' active interaction with peers, with a mean of 3.53.

Table 8

Students' Perceptions of Peer Interaction

Statements	Mean	SD
1. I was able to communicate with peers on this discussion board.	4.47	0.74
2. I was able to share any opinions/views/thoughts with peers in this discussion board.	4.53	0.64
3. I was able to clearly read and understand peers' posts on this discussion board.	4.40	0.91
4. I was able to organize my thoughts and leave a comment after reading peers' posts on this discussion board.	4.47	0.74
5. Conversations/discussions with peers helped me better understand the given topic/problem/prompt on this discussion board.	4.07	1.16
6. I think this discussion board created a sense of community with my peers.	3.00	1.07

7. This discussion board encouraged me to participate actively in the discussion.	3.53	0.92
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Online Discussion Board Activity

Students' perceptions of online discussion board activity are shown in Table 9 using the 5-point Likert scale. Students expressed some satisfaction (M = 3.20) with their online discussion activities. There was some agreement (M = 3.27) on the quality of online discussion activities. Students agreed to a certain extent (M=3.40) on the question of whether they became interested in the weekly topic presented in the discussion activity and showed an almost neutral attitude (M=3.13) to the statement that the discussion activity met the needs of the students. Lastly, about whether to participate in similar discussion activities in the future or to recommend this activity to other friends, the students showed slightly negative responses at 2.73 and 2.87, respectively.

Table 9

Students' Perceptions of Online Discussion Activity

Statements	Mean (5-point Likert Scale)	SD
1. I was satisfied with this discussion activity.	3.20	1.21
2. I think the quality of this discussion activity was good.	3.27	1.22
3. I gained more interest in the topic of this discussion activity.	3.40	1.24

4. I feel that this discussion activity served my needs well.	3.13	1.13
5. I would like to participate in a similar discussion activity in the future.	2.73	1.39
6. I would like to recommend this discussion activity to another student.	2.87	1.41

Overall Feedback

Additionally, all participating students were asked to freely state their feedback on the online discussion activities provided, and nine students responded. The collected responses were analyzed in a precoding method and summarized as (1) advantages of the provided online discussion activities, (2) difficulties encountered when participating in the provided online discussion activities, and (3) improvements for better online discussion activity.

Several students described the positive aspects of the presented online discussion board activity. One student stated, “I loved the idea of assigned roles for the discussion board—that made the discussion much more enjoyable,” and another student noted, “Some great ideas shared by the peers were really inspirational!” One student emphasized the necessity and effectiveness of the instructor's guiding questions, pointing out that the discussion was able to start thanks to the instructor's guiding questions when the discussion did not start due to the moderator’s negligence. Several students also mentioned that discussions are a good idea and that playing roles promotes interaction between students.

In addition, students described the difficulties they experienced with the use of discussion board activities, along with suggestions for resolving those problems. Some students

critiqued that the number of articles provided is too many reading materials for one week. For example, one student stated, “There were too many readings for the discussions. I think the assignment could be made more meaningful by narrowing the scope of readings and make sure they all align with the week’s topic.” Some students stated that smooth discussions were difficult due to the time difference between discussion posts due to the asynchronous format of the discussion board. Other students mentioned that one student's laziness often delayed the entire group discussion due to the small number of students in one discussion group. One student noted, “I do think the groups were too small. If someone did not participate, it threw the whole discussion off.” There was also an opinion that it would be better to structure the discussion activities and, in particular, limit the posting due days for each role. For example, one student suggested, “I think adding a little bit more structure could improve the meaningfulness of the discussions. For example, it was helpful to know that Moderators were supposed to post by Monday and Summarizers should post by Sunday. It would be nice to have similar deadlines for challengers and supporters (e.g., challengers must post by Wednesday, supporters must post by Thursday).”

Individual Interview

A total of 14 out of 17 enrolled students voluntarily participated in the individual interview, showing a high participation rate of 82.35%. According to the interviewees' schedules, individual interviews were conducted from November 30, 2022, to December 16, 2022. The interview time per student ranged from a minimum of 29.36 minutes to a maximum of 59.16 minutes, and the total interview time was 604.9 minutes. Six female students and eight male students participated in the individual interviews, and all students' names were

replaced with pseudonyms. The one-on-one interview was largely divided into two parts: (1) interaction with peers and (2) the discussion board activity. In addition to the questions provided in advance, questions were added according to the responses of the interviewees.

Students' Perceptions of Peer Interaction Using an Online Discussion Board

Q. What did You Like about Interacting with Your Peers?

All the students responded that peer interactions presented the opportunity for students to hear different perspectives on the same topic. One student noted, "I think I learned a lot because since everyone works in a different setting, and or had has experiences, or experience doing different types, or creating different types of courses or learning environments, I really I really love that information." Another student added, "I thought that was a really neat way to go about having more diverse conversations in those boards." Also, several students mentioned that they were able to gain an in-depth understanding of the subject by listening to the opinions of students from various backgrounds. One student stated, "I can learn a different perspective and opinions from different people, and everyone had their unique expertise or experience. So, I can know more informative insights, especially those EdD students who have a lot of plenty for working experience. Yeah, so the kind broaden my eyes." In other words, it appears that peer interaction helps students more deeply understand the given topics by interacting with multiple peers and encountering various points of view from different occupations, education, and cultural backgrounds.

It is true that the way students interact with their peers in an online environment is different from how they do in the classroom and can be limited. So, several students reported that this learning activity involving discussion boards gave them the opportunity to really

connect and interact with other students in a hands-on way. For example, one student stated, “In the online setting, this (discussion board activity) is probably one of the few instances that really connect with one another and interact.” Another student added, “That was particularly useful for me is being able to feel like I was able to connect with other people in the IST program. So, I particularly liked that. And I also liked interacting with others because of the backgrounds that they have.”

Q. What was the Most Challenging Part with Interacting with Your Peers?

Several students pointed out the difficulty of continuing the discussion due to the asynchronous interface of the proposed discussion board. For example, one student stated, “Timeliness was the biggest struggle that we especially when we were waiting for one person to pose a prompt.” Another student stated, “There is not as much continuity with the conversation. And I think it’s harder to develop the conversation because it’s disjointed if that makes sense. ... It doesn’t have quite the depth that a verbal conversation has.”

There was also an assertion that the assigned roles hindered the smooth flow of discussion. For instance, one student noted, “Sometimes when you play their role, playing the role, sometimes limit yourself that you have to agree or disagree in some way with the person.” Another student added, “I like that we had roles, but I think that it was, I guess, harder to interact, because you were waiting for certain people to post.” Several students strongly mentioned that the group discussion was often delayed when the moderator did not upload the first post due to students’ excessive role immersion. For example, one student shared his feeling, “It was a little frustrating when other people would leave the moderation part until like Wednesday or Thursday of the week, and that I was kind of just hanging around.”

It was also addressed that smooth discussion was interfered with by the fact that each group member's contribution increased due to the small group, so even one person's absence greatly impacted the entire discussion. For example, one student noted, "When those first posts weren't posted, it kind of just went dead."

The full-time status of all participating students was pointed out as one of the factors hindering smooth discussion activities. For example, one student noted, "It made it difficult for me to balance my time with the discussion and just stay into the with the flow of discussion." Another student added, "One of the most challenging parts of interacting with peers is just feeling like I had enough time to manage my work schedule and my school schedule."

Q. What would You Suggest a Way to Promote Peer Interaction?

Most students automatically mentioned an approach involving the use of discussion boards when asked how to facilitate peer interaction better. Several students mentioned the need to specify deadlines based on roles. As an example of supporting this assertion, one student stated, "Stricter penalty for not posting on time, especially the moderator or more others, like the Challenger piece, because other might have to wait, like the summarizer has to wait for others to pose. So, I think, you know, making sure people are posting on time by having those stricter penalties. I think that would be a good thing, I think it would motivate others and hopefully eliminate procrastination." In particular, the deadline for a moderator's post was importantly pointed out. For example, one student responded, "I think like having the moderator, like, have those posts by a certain deadline. And then, allowing for all students to kind of give it influenced the moderator on what readings we were going to do. I think those would be ways to improve it."

Some students mentioned that the use of weekly grading on students' posts could improve peer interaction. For instance, one student stated, "Your grade for the discussion each week was dependent on like, how basically how well written your posts were." Another student added, "The piece would be to have each week graded for discussion. So, there's that feedback."

It was discovered that several students found the one-week discussion period to be relatively short for reading and discussing the articles. As a result, these students proposed extending the discussion period to two weeks. The suggested plan involved dedicating the first week primarily to reading the articles and reserving the second week exclusively for the discussion. For example, one student criticized this approach, "If we read the article in the first week, discussing the second week, maybe at that time that everybody had already read it, I think the timeline is one thing like one they can participate in." Another student added, "We can do readings about both of these and hold chord about that one week, and then answer the next week. It was something about the pacing of that two-week period, that allowed for all of the stress, it's like a struggle, always at the beginning of a discussion board for a week, it's always a struggle to get people to get their ideas out."

There were also comments about diversifying the methods of uploading students' posts to discussion boards to promote interaction among students. In addition to text-based posts, there was a suggestion to provide an option to easily upload a short audio or video. For example, one student noted, "If somebody say it is almost like the text message, it doesn't take any more than 10 seconds, was most meaningful it and I want to say I don't really worry about the grammar, I don't really worry about word choices and everything. So, I think we need to

lower down the cost.” Another student added, “I have been successful is, like video or audio response. It adds that additional kind of like, personal conversational field, in a discussion. So that’s something that might be fun to try.”

Lastly, some students asserted the use of a combination of a short meeting and asynchronous discussion. One student stated, “Meet once a week, after selecting those two articles, meet once a week, for 30 minutes, and just share their ideas and just talk and then upload that into the discussion.” Another student supported this opinion, “Set up a Zoom meeting with two or three other people in the class and chat about it. And then together maybe write a post.”

In addition, it was mentioned that reducing the number of articles on the reading list or providing weekly guided questions from instructors is a way to promote interaction with peers on an online discussion board.

Q. Do You Think that Peer Interaction is Necessary or Valuable in Online Courses?

Ten out of 14 students stated that peer interaction was essential to online courses, and two students said it was helpful but not required, and the rest said it could be important or added depending on the subject matter of the course. The majority of students agreed that peer interaction helps students build a community of knowledge. For example, one student noted, “I believe that it builds a community of practice of knowledge, sharing knowledge amongst one another, just learning different perspectives, and based on others’ experiences.” Another student pointed out, “I think peer interaction is very, very important and a necessary component in online classes. ... So, having interactions with peers helps them to feel more engaged. And it also helps them to have that sense of community.” She also added, “Additional

peer interaction in the course and out the course was just very, very important. I felt that I had support in class and also outside of class.” A student brought up social constructivist theories of peer interaction. He stated, “Like the social constructivism, so that we need to construct our own learning through with other. ... The environment is very important. ... you can’t learn it isolated; you need to learn with other people. ... You practically interact with others. You learn from others as well. So that is the reason for benefit to learning.” One student noted, “I think that it builds community among the students. And it also gives students the opportunity to work with other students. And I think when you’re learning, it’s important to bounce ideas off of other people and to get outside perspectives.” Many students thought that peer interaction could build a community among students by allowing them to share their views and learn together. One student emphasized the importance of peer interaction in online learning, saying, “peer interaction thing is one of the keys to success in the online classroom.”

Q. What is the Best Tool or Approach to Support Peer Interaction in Online Courses?

A majority of students indicated that online discussion boards are the best tool to support peer interaction in online courses, adding that they need to be improved to better support interaction between students. For example, one student stated, “I liked the discussion posts the most. ... I think the discussion posts are good because it can be more molded around your individual schedule.” Another student added, “I think that the discussion board is effective and is a good tool. I think because people like to contribute in different ways and learn in different ways.” One student pointed out the good aspects of an online discussion board structure, “I think discussion board is a perfect one. It is just like a blog format. And it is showed as a strength structure and everyone can over have an overview of all postings from peers.”

Several students suggested that additional posting options, such as audios or videos, should be provided to encourage students to participate more in discussion activity. For example, one student stated, "I think just being able to have it write or an audio, like a voice board, I think having those two options would have people more engaged." Additionally, pair discussion was stated to encourage interaction among students on a discussion board.

Students' Perceptions of an Online Discussion Board Activity

Q. What did You Like about the Provided Online Discussion Activity?

Nine out of 14 students responded that the role assignment was the most favorite part of the provided online discussion board activity. Several students noted that assigning roles in discussions with peers fostered individual responsibility and ownership of the discussion, which made them more motivated and, ultimately, increased their understanding of the given topic. For example, one student stated, "I think the assigned roles was awesome because it allowed kind of more guidance. And then also having individual students be the moderator, like every fourth week, basically. Like kind of gave each of us sort of our own time to shine a little bit in our own time to kind of like guide the discussion how we wanted to." Another student noted, "That was probably my favorite thing is just the different roles. Because sometimes, just online discussion can be way too unstructured. Any by providing the different roles, it gives me a clearer sense of, okay, this is what I'm supposed to accomplish more for this discussion. And I also think that you did a really good job of providing documentation for, like the detailed documentation for what each role was supposed to do. That was really helpful. So, I knew what to expect when it was my turn to be the moderator or my turn to be the challenger. Or I knew what to expect because I could read through the documentation and prepare myself to fulfil

that role.” Among the assigned roles, it was also mentioned that the challenger role provided a safe learning environment in which students gave feedback to each other. For example, one student stated, “I really prefer the Challenger piece because it actually challenges me versus, I’ve always tried to avoid saying I agree and because a decade ago have not to say I agree. So, like in a graduate course, my expectation would be the only challenge and like, you can support with lanes, but my expectation is to challenge kind of expand one’s mind in that area.”

There were also several comments that small group discussion increased responsibility along with peer pressure. One student noted, “I think small group definitely works. It’s peer pressure that you know, is a small group. So, and you have a role if you don’t play a role and other people depending on you to fulfil. So, that’s actually a great strategy. I feel if I’m the moderator, all that I need to do this by packet. That’s why I kind of volunteer to be hands because I need that kind of self-regulation on myself.” Some students commented that the small size of a group helped them to have close discussions with everyone in the group. For example, one student stated, “When we are in like 17 students, same time is very difficult. So, I think that (small group) was very smart. ... That makes it a little bit closer the conversation enough and not enough open to interact with other people of the other risks.” Another student also supported the intimacy in the conversations by saying, “There was some intimacy in the conversations, we were able to be when I got into one of the groups that some of the other students who I have connected with.”

Six students responded that the provided guideline document and weekly announcements of group and role assignments were helpful in participating in an online discussion activity. In response to the guiding questions presented each week, one student

noted, "I liked a lot was that you had posted some talking points to get the discussion going. ... it is kind of something to like jumpstart my thinking for the week." Another student mentioned detailed guidelines for writing discussion posts, "I liked the suggested length of the post. So, it was 100 to 200. That was wonderful. When it is over 400, ... I feel it takes away from having a really good discussion." While saying this, he addressed that the concise post helped a good discussion.

Also, some students said they liked being able to have direct conversations with their peers from diverse backgrounds through the discussion activities provided. One student stated, "I appreciated the different perspectives. I changed my perspectives by learning about others' perspectives." Another student noted, "I enjoyed seeing how students at a higher-level kind of format their answers, the articles and how they cite them, and how in-depth they talked about them. So, it was so just good experience for getting kind of like the rhythm like higher end discussions and things like that." He emphasized that he could learn more through the posts of more advanced students. In particular, one student pointed out that it was the most interesting to discuss a given topic with peers according to the assigned role. In addition, some students commented that the group change, which was conducted once every four weeks, was good. For instance, one student said, "I like that the group was changed. So, we were able to interact with various students in the class." Another student added, "I think that was like something very interesting because I had interaction with different people. I have like ideas for different people, where people work or how they develop their own like connections with their writing."

Q. What was the Most Challenging Part of the Provided Online Discussion Activity?

Several students highlighted the challenges associated with fulfilling their assigned roles. One student stated, "It was challenging when I had to be a role that conflicted with my personal beliefs." Another student expressed difficulty with the moderator role. For example, one student noted, "I think the moderator role is challenging. ... I knew it was going out to everyone, it kind of sets the tone of the whole discussion and that's for someone who cares. That's the big thing." One student pointed out that performing roles are more challenging due to the small size of group by stating, "The roles seemed more challenging because there were so few people. ... If there three supporters and three challengers, there's more stuff to challenge, I get the idea of like brining in other perspectives, but if you only have one supporter and one challenger, it's hard to bring in different viewpoints." Another student noted, "The role of the challenger, I think that the most uncomfortable role that people don't like to play and it somehow because you have to be against." Interestingly, one student addressed, "It seemed like the roles, the learners' understanding of the roles really hindered their ability to quickly engage in a discussion board."

Also, some responses mentioned the difficulties created by the small size group. For example, one student stated, "The size of the groups was hard. ... I think bigger group is better because it allows those people who do get in early and do post often, it gives them more to talk about. It also gives the people who come in later, it gives them more to look at, so they have more choice." There were also statements that the small size had a negative impact on the entire discussion due to one student's low or late participation. For example, one student reported that the moderator posted targeted article information too late, leaving him no time

to read selected articles and chat with other peers. Another student commented, “One challenging was people who didn’t fulfill their role during the week at a time that was appropriate. ... Like if the supporter never said anything, that I could never as the challenger, it was hard for me to challenge thing. There wasn’t like a very rich discussion... People not posting in a timely fashion.” One student clearly addressed the relationship between the small group size and engagement, “There was very little engagement taking place. I feel like if the group sizes had been, eight, as opposed to four, that would have led to a little bit more of a natural flow.”

There was also a response that it was not easy to have a smooth conversation due to the asynchronous discussion format, and there was a comment that it was difficult to come up with an answer that fits the assigned role. In addition, due to busy work life, it was hard to upload the required posts according to the deadline. Finally, one student stated the difficulty of locating her group channel every week, and she suggested, “I would only see the discussion I was part of. I had to check which number I was and kind of making sure that I was posting the right discussion. So that was kind of just a little hard to follow.”

Q. What Would You Suggest Regards to Improving the Provided Online Discussion Activity?

All students acknowledged that the role assignments, small groups, and clear guidelines helped them interact with their peers, however, they all agreed that the proposed online discussion board activity needed some improvements. Some students suggested that increasing group size and adding roles to respond to questions would create an environment in which smooth conversations could continue, with some responding to questions raised and others supporting or challenging the answers of other peers. For example, one student noted, “First

suggestion would have to do with roles, I think, having bigger groups where some people are just responders like they don't necessarily have to support or challenge or summarize it, read articles, and respond to the questions. I think having that would be more helpful."

There were some statements that it should be needed to adjust the excessive workload for the moderator role. One student directly stated, "You could probably split that role (moderator) in half." He also said, "You can the moderator role a little bit. ... you provide extra support to the moderators. ... I think in general, allowing the moderator a little bit more time or giving them even just a little bit more structure."

Some students expressed concerns about the weekly-based discussion length and suggested a two-step discussion format. For example, one student stated, "In the beginning of response responding to the initial post, just as with no role first, just so we could get a couple ideas out there and enter again, in round two, with our roles because I think sometimes I felt limited of what I could response I was criticizer, but I support this, but I need to criticize, so maybe just keeping the roles out in the initial post, and then introducing them." Another student noted, "Everyone needs to share their opinions according to your prompt questions first, and then they can choose what roles they want to respond to." Similarly, one student mentioned, "I think having those assigned roles for the first half and then for the second half, allowing students to choose what articles together."

In addition, there were multiple applicable suggestions. One of them was an opinion that the due date for posting of each role should be made clear. For example, one student described this approach, "The moderator posts on Monday, and then maybe the supporter posts by Wednesday and the challenger posts by Thursday. If there was that kind of structure,

that would be helpful.” There was also an opinion that it would be helpful to reduce the number of the required reading list or to provide a full list while addressing the required list. For instance, one student stated, “My suggestion would be like narrowing down like the number of readings because that will help us a lot. ... You have to make a decision about like what readings are essential for the course.” Another student pointed out that all members can choose the target articles together before starting discussion by noting, “It would be better to everyone discussed it first, and then choose that (target reading list).” There were also comments to add more guidelines.

Lastly, some students argued that providing a quick reference to the provided online discussion activities would help students acclimate themselves to the discussions quickly. For example, one student stated, “I think that (quick reference) has a full-on expects like, what this wording, they type of tone. ... So, I think having that actually out, like laid out in a visual, I think that would help a lot of the times, and for me, it would help personally, because I did go back to the syllabus, members of mine,” and another student noted, “There was a document linked in every discussion. ... It is a sheet with a one-page document with an infographic. Something summarizes this point challenger do this. So, what I need to do.” In other words, providing posting rules, role definitions, tasks, and good examples in a “quick reference” format to each small group discussion channel would help students engage in discussion activities.

Q. As for Guided Instructional Strategy, What Worked Well and did not Work?

13 out of 14 students responded that providing the guided instruction helped their discussion activities. For example, one student stated, “If you don’t guide discussion, especially because it’s asynchronous, you know, people just kind of post whenever that if you don’t

provide any kind of framework, it can kind of go in one direction and not really cover. So, I think that the guidance provided good structure for the discussion.” Another student noted that the guided instruction was helpful, and specifically, stated, “I definitely think the guided instruction was helpful. ... having that first prompt was really helpful. ... those guided questions, even if the people don’t respond to them. I think it helps prompt, just facilitate one’s thought.” There were comments on the provided guidelines. For example, one student asserted, “I think that’s especially in the beginning, it definitely works because people are aware that this is almost like a rubric.” Other students noted, “I did find that helpful the guiding questions. ... it was helpful to have your questions at least to guide me and post positive answer,” and “It was helpful to add those guiding questions when the conversation needed a little bit of a jumpstart. I do think that was helpful because sometimes people are stuck.” Also, one student mentioned, “I can read the articles with those questions. So, it can improve my reading efficiency and I can have a bit picture or have a general sense.” Similarly, some students commented on the usefulness of the guidelines provided. One student noted, “it works a lot. I like guideline like how to write a post about ... that kind of like description of the roles, they were very helpful.” Another student added, “I like your outline, was very useful to get an idea of what was expected of me as a student in the class.” Lastly, there was a comment on the instructor’s monitoring of the discussion. For example, one student stated, “I do think keeping an eye on the groups and providing, when necessary, is helpful.”

Q. What Information Do You Think Should be Provided to Guide Students in an Online Discussion Board Activity?

All students agreed that the provided guidelines were helpful for discussion activities. However, some students emphasized the need for additional content or clarification in the guidelines. One student commented on the usefulness of the guidelines regarding writing a discussion post, arguing that they need to be more rigid. So, he noted, “right amount of instruction, but it wasn’t super rigid. ... The guidance of breaking up the posts for a single topic was helpful. So, then it made it easier to reply to a certain part of what someone was saying.” Another student asserted the need of good examples for concise posts, and stated, “I thought that you laid out like a good kind of template for how it should be.” Interestingly, one student suggested how to use the guidelines provided effectively, and she stated, “this person is named challenger, and then underneath that, click this link to see role responsibilities. ... popup or document opens up with an infographic that shows moderator what I need to do.” She pointed out that while the provided guideline document and information provided are detailed and good, most students either skim through the text or have difficulty remembering the content as they write, even after reading the document. So, she suggested that linking or adding pop-ups to the weekly discussion channel would allow students to quickly reference and write posts that fit the guidelines as needed and fulfill their assigned roles well.

Q. As for Role-based Instructional Strategy, What Worked Well and did not Work?

All students responded that the role-based format helped their discussion activities. For example, one student noted, “I think that the role assignment was effective in kind of guiding the discussion.” And he added, “I think that overall, that the role-based work because it kind of

sets the expectation for each learner, kind of like as how they're supposed to approach that week." Another student addressed the specific attributes of the role-based format by stating, "it's really good that just, you know, have the person choose whatever articles and like somebody that be a specific role." She also mentioned that during the 15 weeks, groups and role assignments were pre-assigned so that all students in this course could equally perform each role, which is the fairness pursued in this learning activity by noting, "There is the fairness piece as well, ... make sure everyone you know, is equally a moderator equally supporter." Especially, one student reflected on the use of role-based discussion activity, as follows: "I think that the role-based can work" but she simultaneously addressed the aspect of excessive sticking with the assigned roles by stating, "I think that it limits participation in some way, in some ways, because for example, the summarizer generally doesn't come in till the end." However, she pointed out the good aspects that role-based activity by explaining, "I think there can be benefits to the role because it encourages people to bring in different perspectives and take different standpoint" and "I get that idea of like having somebody responsible for it." Also, she suggested that it might be a good idea to have small groups without roles or with a single moderator as an approach to releasing the issue of excessive role involvement. Lastly, another student commented on the small size of the group by admitting that the role-based format had a positive effect on discussion activity and suggested, "I think the roles like adding more people than I think the roles would be even better." Similarly, another student agreed that role-based activity work well, but she commented on the related issues, such as "it is a lot of time-consuming" or "somehow is very difficult. ... They work or they have family. We have to keep a

balance itself.” In particular, one student described well how the proposed role-based format positively helped discussion activities. She noted as follows:

I think it worked. ... I completely got so engaged in the conversation many times that I did continue playing along with the roles. And it was interesting. ... I can bring this up, like roles and responsibilities for students with within their project-based learning unite they were doing. ... I know that what I got out of the conversations was really good information and really good. A really good learning environment. ... As we progress through the program, we become more familiar and more comfortable with the students ... dialog becomes more natural.

Q. What Roles Would You Assign for an Effective Online Discussion Board Activity? And Why?

All students responded that no additional roles were needed for the currently provided discussion activity. For example, one student noted, “I think that those four roles kind of covered the majority of like responses that you’d be looking for productive discussion.” Another student pointed out the problems with role increases and reductions, stating, “I think adding more roles would make it more complicated. Taking it away would increase pressure on the students. ... When everyone is four of us, we all have a role. I think it makes for a better discussion.” There were more comments on the number of roles, such as “I think it is important to have still four different roles” and “I think all four roles are necessary and indispensable.”

There were some comments on reducing the number of roles. For example, one student indicated that “If we combine supporter and challenger, ... then those two roles you know they could decide in the week I want to challenge this or I want to support this.” Similarly, another student mentioned this, but he addressed keeping all the current roles by stating, “Only one

person would be assigned the moderator of the week, but then the rest of the people, maybe they get to select the role that they want.” Another student offered role reduction and addressed the need of the clear guidelines and examples of each role, “I think the role is definitely to just two roles, having two roles, the moderator and challenger with constructive feedback. I think having those two roles, and the setting those guidelines, and then having examples to with for each of them.”

Also, while some students admitted that the role-based structure was good, they insisted on explicit guidelines for some roles. For example, one student stated, “The structure is good. ... I think the summarizer maybe needs a little bit more clarity ... maybe there’s three questions and then there’s three initial posts from the moderator. And each of those questions and those threads could be summarized and then an overall summary.”

Q. What Roles do You Think is the Most Critical in an Online Discussion Board Activity? Why?

12 out of 14 students agreed that a moderator role is the most critical in online discussion. There were several reasons why they think a moderator is essential. For example, one student noted the importance of the moderator’s role in having an online discussion. As she stated, “I would say that moderator was the most critical because they’re kind of setting the pace for the group that week. ... They’re just the source of information that all of the other group members work from.” Other student pointed out the possible negative effect to explain why a moderator is crucial in online discussion by saying, “The moderator would be the first one. ... start the whole thing,” and described, “If the moderator is late, ... for adults, ... wanted to wait a little bit, ... I lost that opportunity to post this.” He also mentioned several important moderator’s tasks, such as “Remind people ... people haven’t shared, please do share,” or “It’s

the one that assists me, to give me more opportunity to say you have 10 minutes.” Another student supported his assertion by stating, “The moderator is the most important. ... Not only are they picking the discussion off, ... nudge people to dive in and get going on the discussion.” Most students addressed that a moderator played a crucial role because they can initiate the discussion and support them to continue the discussion that week.

Some students mentioned supporters and challengers as roles that are important because they can bring different perspectives to the discussion. For example, one student explained, “Supporter and challenger because they are the ones who bring, according to what I saw in this class who would bring extra points or extra ideas to the discussion,” and she pointed out the challenger’s role by noting, “challenger has to always find a point that is bringing new ideas that challenge the status quo.” Another student added, “Having challengers, ... to provide at least one outside resource, I think that would add another dynamic to the group to it as well.” There is a comment on the role of challenger, such as “Challenger is pretty critical. ... Otherwise, people will just keep agreeing with each other.”

Notably, one student argued that all roles are important in online learning. She clearly indicated, “I think contributing is the most important, ... I think the contribution is what’s important because you have to read other people’s thoughts and think about how that fits into what you’ve read. So, I don’t necessarily know that any one role is most important. I think as long as you’re engaged in the conversation, you’re getting something out of it.”

Q. Which does You Think is a More Effective Role Assignment by an Instructor or a Free Role or No Role?

In this study, the instructor announced the assigned roles weekly and group-shift every four weeks. Seven students agreed that the role-assignment by the instructor is more efficient, with one fully free choice, and four students mentioned the semi-structured free selection is the best.

Several students commented that role-assignment is efficient but criticized that students may only choose relatively easy roles if free selection is offered. For example, one student noted, "I liked the assigned roles because I think it forced you to like go out of your comfort zone with different things, and then it gave everyone the opportunity to be the moderator." Other student supported this opinion by saying, "I mean assigned the role is essential. ... people are not goanna take positions about difficult roles." Also, another student pointed out the need of role-assignment by addressing, "Sign up. ... Would probably work. ... If they don't choose, nobody has chosen anything." Similarly, another student asserted, "The most effective is the role by instructor. ... going to that fairness piece making sure that there's that piece that I think it really influenced like the direction of the discussion." She also pointed out the importance of having a role in discussion by saying, "It just didn't feel as meaningful by not having roles. So, it was nice to have that person who set the tone of the discussion."

The rest of the students also agreed that if role selection is left to the students, only the easier roles can be chosen, and in the worst case, there may be roles that are not chosen. So, these students proposed a method called semi-structured free choice for role to prevent this problem from occurring. For example, one student stated, "Everyone must choose a moderator

one time, then the summarizer is the same, and support or challenge, can choose what they like.” Similarly, another student described, “I do think that having a moderator selected every time by the Instructor is needed.” Most students indicated that the moderator should be chosen at least once, in case of free role choice, or that the instructor should select one student every week. Notably, one student stated, “Pre-assign at the beginning of the semester, and everyone knows this is my week to moderate,” and said that all students can comfortably play the role of mediator at least once.

Interestingly, only one student said the free choice of roles would be more effective. She added, “If everyone is going to be allowed to do their role and do another role, why not just let people choose? ... even if you tell them this is your role, but you can contribute whatever you want. ... I think free selection is good for role selection.” It seems that even if a role is assigned, students can perform other roles if needed, so she thought it is better just to allow students to choose their roles freely every week.

Q. As for Small Group Instructional Strategy, What Worked Well and did not Work?

All students responded that they liked the strategy of assigning all students to small groups and conducting discussions. For example, one student mentioned, “I think small group definitely works. It’s a peer pressure that you know, is a small group. So, and you have role if you don’t play a role, and other people, depending on you to fulfill. So that’s, that’s actually a great strategy.” Another student supported, “I think with the class size that we have right now, with 17 students, I think it makes a lot of sense to just have to separate groups.” Especially, one student pointed out, “Something that I really like is like, with we divided into small groups. ... Because when we are in like 17 students, same time is very difficult. So, I think that that was

very smart. It's like a small group setting interacting. So that makes it a little bit closer the conversation enough and not enough open to interact with other people of the other risks. And also, something that I really like it is about a part they that we play. I mean, we always we have a shift every four weeks."

However, there were some negative comments on the group size, four to five. For example, one student stated, "If you have a small group have like four people and one person is not participating, right, you can really limit that discussion." In particular, when a moderator is late to upload the first post, the entire discussion is delayed, such as "First posts weren't posted, it kind of just went dead." Also, another student stated, "there was someone who didn't respond, or two people that respond early in the week, or maybe didn't respond at all, then that's just less of a perspective that that you get right from, like, you get less perspectives,"

Q. What do You Think is the Group Size for an Effective Online Discussion Board Activity?

Why?

As for the optimal group size for effective online discussions, students have found that they prefer 4-6 students in a group at most. One student commented on the small group size, "I think that the smaller the group provides more opportunity to speak, right, so more or to go farther in the conversation or something that you want to discuss." Another student pointed out the number four by stating, "I think four is good for giving each team member experience because as we rotate through the groups, each of us was a moderator. ... I like to kind of keep it simple." Another student stressed the limitation of a small group with four, but she added, "If you have a small group with four people and one person is not participating, you can really limit

that discussion. ... I think at a graduate level course, smaller groups are better.” In short, four may work in this graduate-level online courses but may not work in undergraduate online courses. Then there were a few students who preferred a group size of six to eight. For example, one student noted, “I think probably between six and eight, even getting beyond like ten is, is even a lot, although what we’re doing right now is not bad.”

Two out of 14 students reported that they prefer to have 7-10 students in one group. For example, one student stated, “The small group size in general, if there was someone who didn’t respond, or two people that respond early in the week, or maybe didn’t respond at all, then that’s just less of a perspective. ... Like a larger group of ten, for example, I think there would be more of an opportunity to get more perspectives.” Interestingly, one student three is good for online discussion, and she indicated, “Three is more perfect. One is a moderator, and the other two summarizers.” No convincing statement has been made as to why a group size of three is appropriate for online discussions.

Q. As for Reading Materials, How Many Materials Do You Think are Appropriate for Reading and Discussing Effectively in a Week? Why?

Students' responses to the reading material were generally twofold: appropriate and too much. In the case of students who answered appropriate, they responded that there were not many because the moderator first selected and provided two or three articles and was free to read more articles from the provided list. For example, one student noted, “I really liked there was like seven or eight different kinds of like options listed in the syllabus for each week. But then the moderator would choose like two or three. It is the right balance.” Another student differently explained, “It is perfect. 10 -12 articles and I think of instructor said read

these two, that it takes away a choice and you know, forces us into reading something that we might not be interested in.” There was a comment to mention the learner autonomy, as follows: “A long list and letting the student choose because it promotes student autonomy and learning supports universal design for learning which of so in graduate level students, too, I think you can put that responsibility on us learners because I think we’re not new to the learning experience.” Most students responded positively to the method of providing a reading list related to the topic and allowing the students to make their own choices. However, there was also an opinion that it would be more effective to divide the reading list into required and additional. For example, one student stated, “I think the required piece is great. And knowing like, okay, these are the ones that my instructor wants me to know or to read, going forward into this discussion.” Another student added, “I mean, that’s just me, and then maybe having that additional resources optional, right is, but I think, it’s important to point out which articles are going to be that main focus of the topic.”

Conversely, eight students reported having too many reading lists to finish reading in a week. Most students responded that 2-5 are the appropriate number of readings per week. Two is the number that many students mentioned as a perfect and manageable number. One student stated, “three would be the maximum. ... the appropriate two is manageable.” Another student mentioned, “He (instructor) wants to share all of the information that we possible can one a topic. But I think for the discussion itself, it would have been nice to say, maybe these two readings are required and here are some other supplemental or optional readings. ... I find journal articles; I find very difficult to read.” In particular, the majority of the students preferred that the instructor assign approximately two required readings weekly. For example, one

student shared her experience on having two required readings, and she noted, “Every week, we need to read two articles in another class, it is also helpful because we can have a close rate. ... it became help us to digest a one theory paper and besides the two articles.” She also added, “If we are to choose two out of the ten articles, it is also extendable because we can choose articles we want, but it is hard to say maybe not very suitable for discussion. ... Totally different article. ... hard for us to interact and share our opinions.”

In addition to this, one student replied that it is effective for all group members to decide together what articles they want to discuss before the actual discussion begins. As he stated, “I think the list multiple articles and then vote as a group. It brings up error and brings in the engagement piece from the very beginning. It’s a very low risk, easy engagement. ... If you could do a poll, on which articles you want to read for the week, that’s started out the week with the poll, boom, everybody, then then the moderator, the summarizer got the moderator can get on it, and they can do their roles. ... initiates a very low risk, easy engagement with the group.”

Q. Do You Think Instructor’s Active Involvement in an Online Discussion Board Activity is Helpful? Why? If not, Why?

All students responded that the instructor's active participation in the discussion activities was valuable, helpful, and good. To the question of how helpful the instructor’s active participation in the discussion was, various answers came out. Some students reported that they are well supported by the instructor, which can be a guidance or a positive reinforcement. For example, one student noted, “I would see a post from the instructor, and he’d be like, oh, great work here was like that was made me feel like I was on the right track.” Another student

added, “I mean, the professor contribution to the conversation of the discussion is essential because one they make like the out that the professor is paying attention. ... the professor at least provides some feedback, okay. Then you see, you’ll feel like a more confident that you are participating is like, okay, so I’m doing something well. ... He motivates me to move to the next scene, wait for the conversation.” One student pointed out the instructor’s presence, “So, it’s like trying to figure out how the instructor can be present and engage as that guide without overwhelming themselves.” He also mentioned the building community, “Original conversation of community and building community, ... Part of it’s to build that peer network, build that community.” He commented on the instructor’s summary, “In a debrief from the instructor, they point out something you should really go check out. It seems to me; everybody would get benefit from that.”

Notably, there was the comment that timely feedback is more important by saying, “It really did highlight the impact that that feedback and especially timely feedback, you could actually do to motivate a learner.” Another student supported this point, “It really did highlight the impact that that feedback and especially timely feedback.” So, one student addressed the instructor’s late feedback, “I noticed that he (instructor) went back and posted after the discussion. ... So, I didn’t really reflect on what he had written. ... I don’t really see a need for the instructor to go in there to post.”

Q. What is the Best Frequency of Having an Online Discussion Board Activity?

When asked about discussion frequency, nine out of 14 students indicated that weekly was the most preferable, as currently offered. One student pointed out the problems that can arise in the case of bi-weekly, “A few students might post on this week and done and respond

to who they need to respond to and be over with. And then the next week, one or two students might post, and then if they respond to other people, those people had already responded last week, so they're not going to respond." Some students even came up with compromises based on the weekly discussion posting. For example, one student noted, "One of the weeks when I had a lot of going on if you need to use a discussion free card," whereas another student stated, "Maybe taking the week off that major assignments are due would be nice. ... I think weekly is good." Also, several students mentioned the flexible frequency based on the topic. For example, one student offered, "Definitely weekly if it's realistic, but definitely basing on the assignment." Another student supported, "Maybe depends on the topic of the week. ... Instructor decide this topic may take two weeks, but this topic, just one."

Three out of 14 students preferred bi-weekly. Interestingly, the biggest reason being that one week is too short to read and discuss a large number of articles. For example, one student noted, "We took a week it was it was just hard to last week, like, read those and then fit the whole discussion into a week. Whereas let's say we had 16-20 articles over the course of two weeks I think people would have more time, and even if they didn't like even if they register three or four of them, they could still contribute more." Another student added, "We have two weeks to do it. Maybe four or five times where it would give you more time to have a higher quality answer. ... People have more time to respond with a more detailed answer."

Discussion Posts

The target course was held for a total of 15 weeks, from August 22nd to December 11th, 2022, and a list of discussion topics (see Table 3) and related articles per each week was provided by the instructor before the course started. To directly observe students' discussion

activities using the proposed discussion board, the lead researcher collected discussion posts every week for 15 weeks and evaluated the rate of student participation, the persistency of discussion activities, and the pattern and quality of posts. Role assignments and group formations were already completed and distributed to all enrolled students prior to the start of the course, but in the 9th week, one student dropped out of this course due to personal reasons, so there was a slight role change. So, the posts uploaded by this student were not considered when analyzing the collected data.

In this study, there were three data entries: (1) four groups without assigned roles, (2) four groups with four assigned roles, and (3) two groups with two assigned roles, a moderator and summarizer. During the entire course period, students were already informed of all matters related to an online discussion board activity and were assigned to small groups to conduct group discussions. In the 1st week, all students were divided into four groups and had free discussions without assigned roles. This one-week practice period allowed students to adapt to the new online discussion board activity format. From the 2nd to the 13th week, students were divided into four groups, and the roles of moderator, supporter, challenger, and summarizer were assigned to each student in a group. After performing all the roles within one group for four weeks, the students were assigned to a new group and had to play all four roles again. It was intended to provide an opportunity to discuss more than once with all students enrolled in the course through group change. During the 15 weeks, a total of 5 group changes occurred. During the 14th and 15th weeks, students were divided into two groups (9 and 8 students per group) and assigned only two roles: a moderator and summarizer, while allowing the rest of the students to decide their own roles and participate in the discussion.

The collected discussion posts were divided into two categories, (1) discussion observational data, and (2) authentic interaction, and then analyzed. The first category is discussion observational data per week: participation rates, consistency of participation, the number of students per conversational thread, and the number of posts per conversational thread. This data category was used to determine the quality of interactions that occurred while showing whether conversations among students actually occurred using the provided online discussion board. The other category is authentic interactions that occurred among students using the online discussion boards provided. The authentic interaction is the most essential factor in determining the quality of online discussions. In this study, a lead researcher observed whether students engaged in discussions while performing well in their assigned roles, assigned rating levels on their discussion posts on a scale from 3 (highest) to 0 (lowest), and determined whether there was authentic interaction based on their assigned rating levels (refer to Table 6).

Discussion Observational Data per Week

The Number of Discussion Posts

The number of posts collected for a total of 15 weeks was 1,044, and an average of 69.6 posts were uploaded per week. This result was displayed in Figure 9. In Week 1, 69 posts were collected, and in Weeks 2 to 5, 78, 73, 91, and 90 posts were gathered, respectively, which was more than the average number of posts per week (69.6). Then, from the 6th to the 9th week, the number of posts gradually decreased to 76, 58, 52, and 43. However, the number of posts increased again from week 10, and week 12 had the most posts collected at 94. Even though one student had to drop in the 9th week, the impact seems to be minimal. Lastly, in the last

two weeks, 55 and 62 posts were collected, which were less than average number of posts per week (69.6).

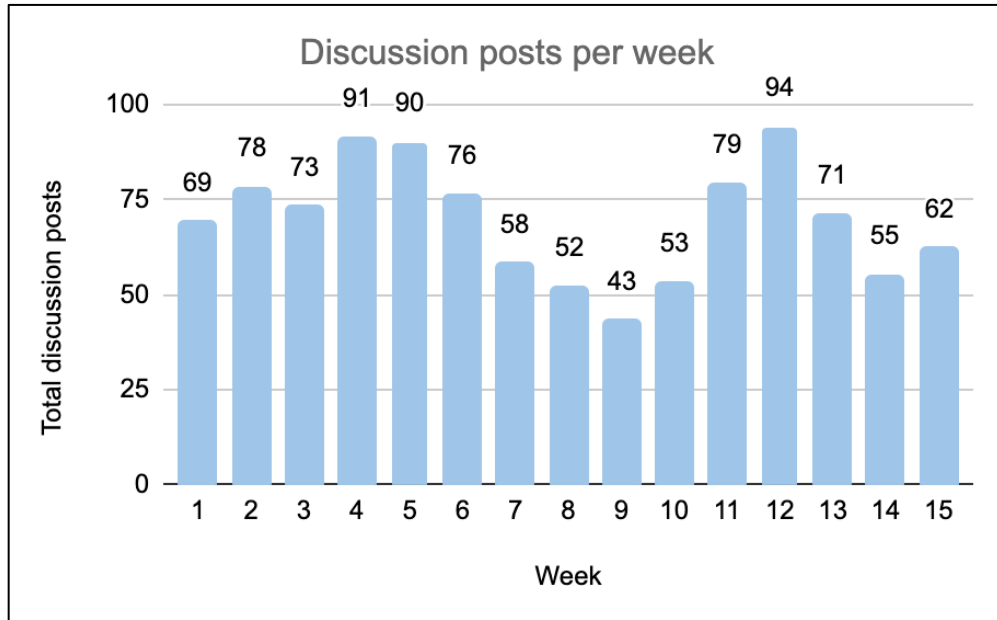


Figure 9. Total discussion posts per week

Student Participation

The participation rate is a conceptual framework factor used to evaluate the quality of asynchronous online discussions (see Table 5) and was first calculated based on the number of posts uploaded by one student per week. As shown in Figure 10, the average number of posts by one student per week ranged from a minimum of 2.41 to a maximum of 4.12 over the entire 15 weeks. For accurately measuring student participation rate, the number of posts posted by instructors and by the student who dropped out of this course in the 9th week were not counted. The number of posts by one student per week was transferred to the 4-point Likert scale from excellent (4) to poor (1) based on the scale in Table 5 and displayed in Figure 11. The average participation rate per week ranges from a minimum of 1.75 to a maximum of 2.5.

Participation rates lower than **Satisfaction** (2.0) appeared in the 3rd week (1.94), 9th week (1.75), and 13th week (1.94), which occurred a total of three times out of 15 weeks.

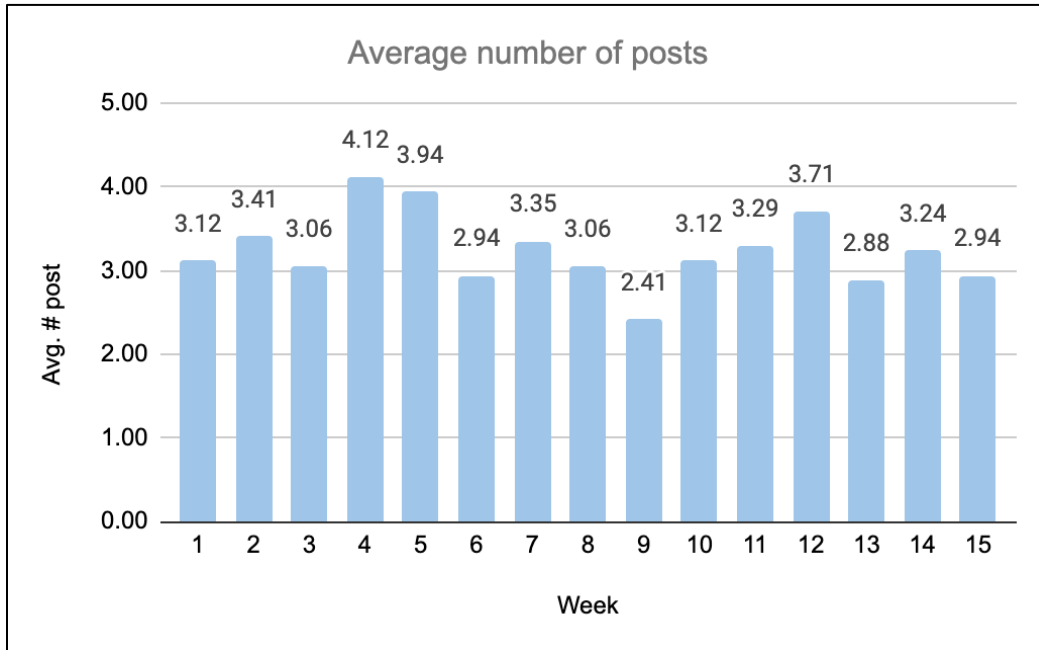


Figure 10. Average number of posts by one student per week

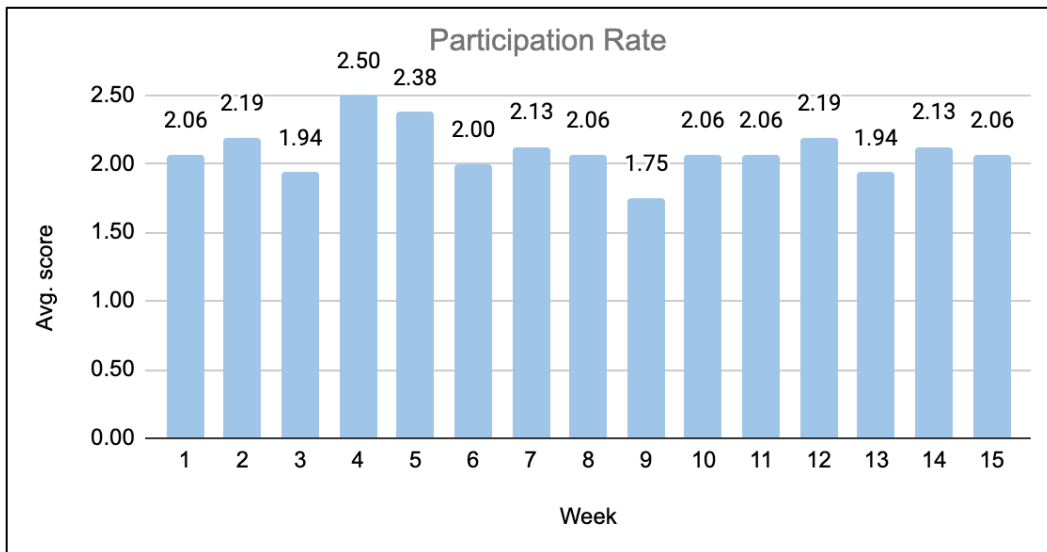


Figure 11. Participation rates

Consistency of Participation

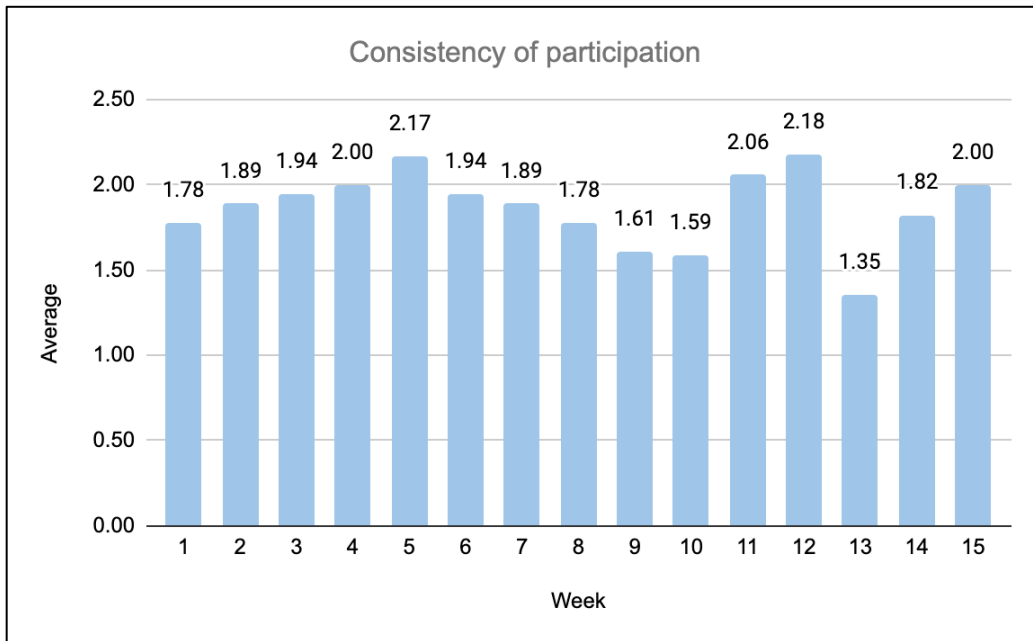


Figure 12. Consistency of participation

One of the critical factors determining the quality of online discussions is the continued participation of students in discussions. The number of participating days by one student per week was counted and converted into a score scale from excellent (4) to poor (1) in Table 5, calculated as an average value and shown in Figure 12. The persistence of students' discussion participation varied over the entire 15 weeks, with a minimum of 1.35 and a maximum of 2.1. Persistent participation rates higher than **Satisfaction** (2.0) appeared in the 4th week (2.00), 5th week (2.17), 11th week (2.06), 12th week (2.18) and 15th week (2.00), which occurred a total of five times out of 15 weeks. In summary, overall student participation persistence was considered slightly less satisfactory.

The Number of People per Conversational Thread

The number of students participating in one conversational thread is one of the crucial factors in related to the quality of online discussions (see Table 5). In principle, only the number of students participating in one conversation thread should be counted, but in actual conversations, there was sometimes an instructor’s participation, and his participation played an important role in continuing the conversation, so it was also counted without being excluded.

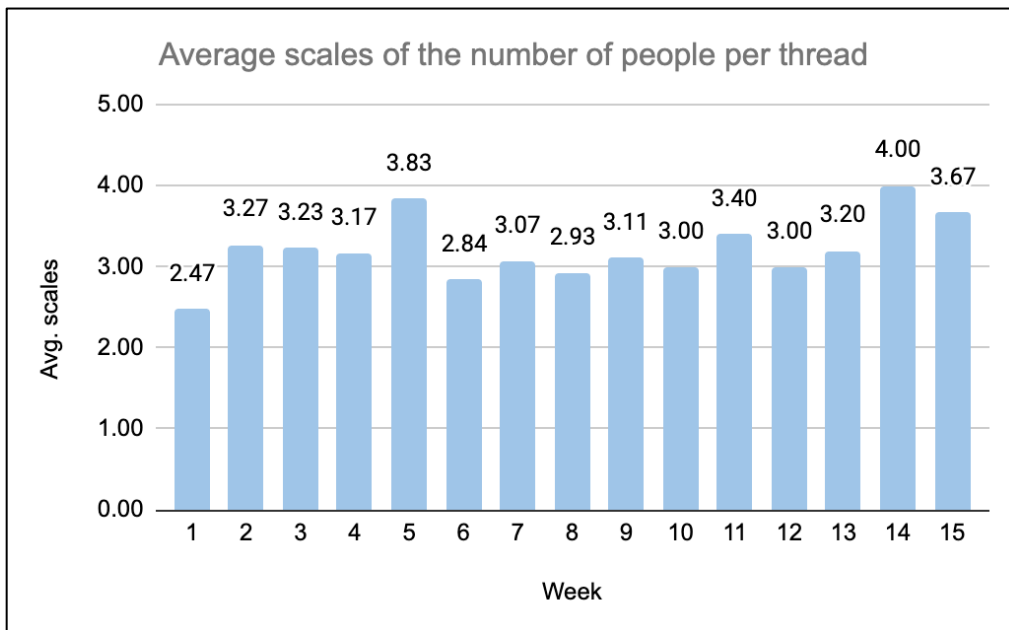


Figure 13. Average scales of the number of people per thread

The number of people per conversational thread was counted and converted to one of the scales from excellent (4) to poor (1) based on Table 5, and the values were averaged on a weekly basis and displayed in Figure 13. During the 15 weeks, the lowest scale was 2.47, and the highest scale was 4.0, which can be seen as quite **Good** based on the rubric from Table 5. In particular, during the 14 weeks after the roles were assigned to students, except for the 6th and 8th weeks, all scores were higher than 3, indicating that more than three people

participated in one conversational thread. In particular, in the 5th week, with a scale of 3.83, it was revealed that almost four students participated in one conversational thread, which is considered a fairly high number considering that four or five students were assigned to one group.

The Number of Posts per Conversational Thread

The number of posts involved in one conversation thread is considered one of the key factors in online conversation quality, as it indicates how much interaction there is between students participating in a conversation (see Table 5).

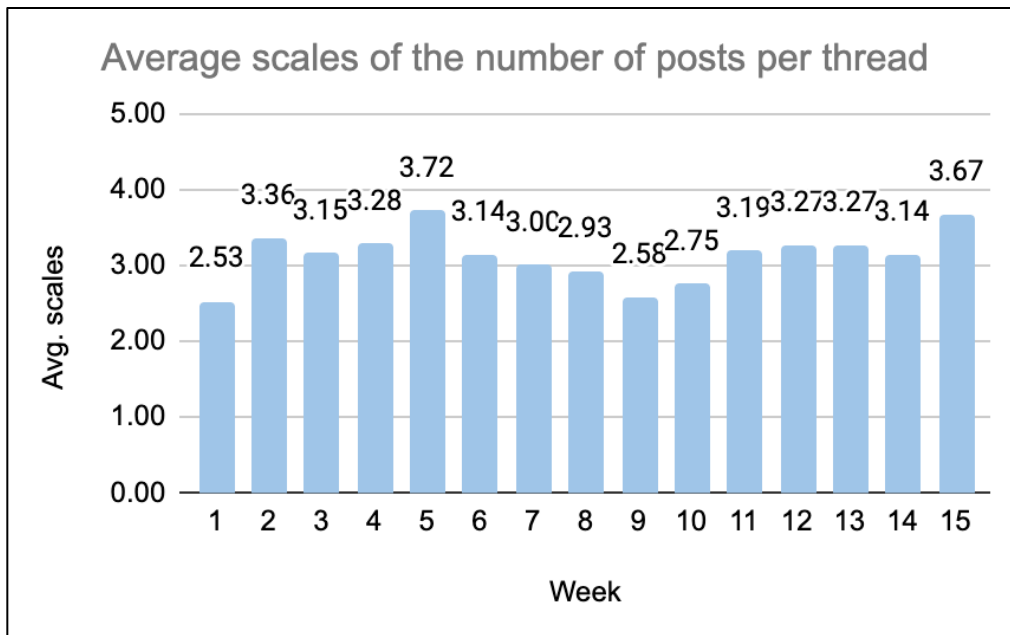


Figure 14. Average scales of the number of posts per thread

Each week, the number of posts per conversational thread was counted, converted to one of the excellent (4) to poor (1) scales based on Table 5, and then averaged and displayed in Figure 14. During the entire 15 weeks, the minimum scale was 2.53, and the maximum was 3.67, indicating that a **Satisfactory** conversation took place each week. In particular, in the first

week, when there were no roles and discussions were conducted in four groups, it was a **Satisfactory** conversation with 2.53, while in the 14th and 15th weeks, when two roles (moderator and summarizer) were assigned and discussions were conducted in two groups, the scales were 3.14 and 3.67. It was confirmed that a quite **Good** conversation was carried out. From Week 2 to Week 13, the minimum was 2.58, and the maximum was 3.72, indicating that there was a fairly **Good** interaction. In particular, during the 13 weeks, it can be seen that there were more than 3 posts in one discussion thread except for the 8th week (2.93), 9th week (2.58), and 10th week (2.75).

Authentic Interaction based on Role Performance

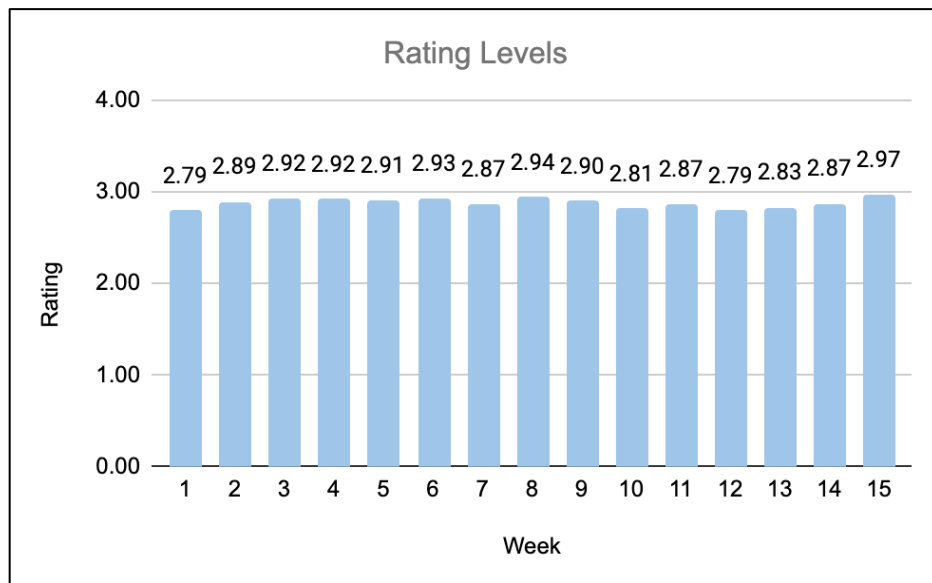


Figure 15. Rating levels of posts

In this study, authentic interaction was assessed based on how well students performed on task-specific roles in weekly discussion groups. The students' posts on the discussion board were analyzed to assign roles suitable for the tasks performed, and each post was given a rating level from the highest (3) to the lowest (0) according to the degree of role performance based

on Table 5. Posts classified as general and by an instructor were not included in the final rating level calculation. Since authentic interaction, as defined in this study, means taking place during actual discussions about a topic between students, it is reasonable to exclude these types of posts that are not related to the topic presented. The rating levels of the posts during the 15 weeks were calculated as average values per week and displayed in Figure 15. As shown in Figure 11, the minimum level of 2.79 and the highest level of 2.97 are shown, and it is considered that the required tasks for a specific role have been performed well without a significant difference for the entire 15 weeks.

Chapter 5: Discussion and Conclusions

Introduction

In this chapter, the results of this study were summarized and discussed based on the stated research questions. This chapter interpreted the study results described in the previous chapter and discussed similarities and differences with previous studies. Next, the limitations of this study were described, implications for practice, and future research and research directions regarding using a discussion board for peer interaction were discussed. Finally, the findings and values of this study were concluded.

Summary of the Study

The primary purpose of this study was to investigate whether three instructional strategies: (1) guided instruction, (2) role-based discussion, and (3) small group discussion, were helpful in facilitating interaction among students in online discussion boards. In addition, this study explored how to design an online discussion board to promote interaction among students based on three instructional strategies. In particular, this study demonstrated that properly designing and applying well-known instructional strategies to asynchronous online discussion boards, the default features of the Learning Management System (LMS) widely used in online learning, could provide an environment where students can interact with each other online without introducing new tools or software.

To achieve these purposes, this study adopted a mixed-method design that collects both quantitative and qualitative data on the same learning activities of students (Cameron, 2009; Creswell & Plano-Clark, 2017; Zhu, 2022; Zhu & Bonk, 2019). In particular, an explanatory sequential mixed methods approach was used in which quantitative data on the same learning

activity is collected first, then qualitative data is collected, and learning activity is analyzed by linking the two data sources (Cameron, 2009; Creswell & Plano-Clark, 2017; Zhu, 2022; Zhu & Bonk, 2019). However, this analysis method was slightly modified and applied to suit this study.

During the 15 weeks of the course, a lead researcher gathered the logs of students' discussion activities every week and developed an online survey and interview questions based on the accumulated approximate discussion log data. In addition, based on the online survey and individual interviews conducted from the 13th week and the students' posts collected every week, in the 14th and 15th weeks, the discussion group was divided into two groups of nine and eight students, respectively, and only the role of moderator and summarizer was assigned. In more detail, two roles were assigned to two students by an instructor, and the remaining students were asked to participate in the discussion by deciding on their own roles.

In this study, 15 online survey responses and online discussion board logs were collected as quantitative data, and they were analyzed via descriptive statistics using SPSS and Excel. Also, a lead researcher gathered 1,044 online discussion board posts and 14 individual interview transcripts (in total, 604.9 minutes) as qualitative data and analyzed them using content analysis.

A lead researcher selected two evaluation factors, student satisfaction and peer interaction, to examine the effectiveness of the discussion board learning activity to which the proposed instructional strategies were applied. The first research question was developed to determine student satisfaction with the provided online discussion board activity. The second research question was developed to determine whether meaningful interactions among students actually occurred in the provided online discussion board activity. The answers to

these two research questions were based on the following four collected data, (1) online discussion board logs, (2) online discussion board posts, (3) online survey responses, and (4) individual interview transcripts.

Research Question 1: How do Students Perceive Discussion Board Activities Designed Using Guided, Role-based, and Small Group Instructional Strategies?

The results of the online survey displayed in Table 9 found that while students found some value in the online discussion board activities, there is room for improvement in terms of meeting their needs and interests. The negative feedback regarding future participation and recommendations also highlights the need for further exploration into how to better engage and motivate students in similar activities. Based only on these numerical (quantitative) results, it can be concluded that student satisfaction with the proposed discussion activity was almost neutral and had little educational effect.

However, students' additional comments and in-depth individual interview transcripts revealed new aspects of students' perceptions of the provided online discussion activity. Contrary to the slightly negative results of the online survey, all students responded very positively to the provided online discussion activities. All participating students acknowledged that the asynchronous online discussion activity allowed them to share their views with their peers and that this opportunity helped their learning. These results are well aligned with those of previous studies, which argued that asynchronous online discussion boards, which provide opportunities for students to interact with peers by reading and responding to their posts, are an important component of online learning (Aloni & Harrington, 2018; Lesht & Schejbal, 2020; Nandi et al., 2009; Song & McNary, 2011; Swan, 2002).

More specifically, this study revealed that students were satisfied with the intentionally designed features of asynchronous discussion boards. Guided instruction, role-based discussions, and small group discussions were mainly mentioned by participating students as their favorite aspects of the online discussion activity provided. Several students pointed out that role-based discussions gave students the opportunity to think about a given topic from a different perspective and communicate their thoughts with their peers (Aloni & Harrington, 2018; Hou, 2012; Gu et al., 2015; Lesht & Schejbal, 2020) while instilling a sense of responsibility and ownership in the discussion (Gu et al., 2015; Lesht & Schejbal, 2020; Wise et al., 2012; Yilmaz & Yilmaz, 2019). In particular, the results of this study confirmed that role-based feature can motivate students to participate in discussion activities (Hou, 2012; Lesht & Schejbal, 2020; Yilmaz & Yilmaz, 2019).

Next, this study found that the small group discussion environment increased intimacy among the group members. Such intellectual intimacy enabled a more extensive discussion by encouraging students to understand the given topics more deeply and not be limited to the presented learning material (Akcaoglu & Lee, 2016; Kim, 2013; Lesht & Schejbal, 2020; Martin & Bolliger, 2018; Qiu et al., 2014). Another finding was that the small number of posts uploaded in a group allowed students to join the discussion quickly at any time without being overwhelmed by a huge number of posts (Aloni & Harrington, 2018; Kim, 2013; Lesht & Schejbal, 2020). In addition, this study showed that small group formation enabled students to have more opportunities to express their opinions, thereby increasing their contribution to the discussion and further increasing their sense of responsibility for the discussion (Akcaoglu & Lee, 2016).

Lastly, the findings of this study supported that the structure of online discussions (i.e., rubrics related to postings) and the provision of clear guidelines (i.e., tasks for each role) helped students participate in discussions without difficulty (Aloni & Harrington, 2018; Lesht & Schejbal, 2020). In particular, many students stated that the guiding questions were helpful for discussion, which is well aligned with the previous study that guiding question prompts can result in the quality discussion by promoting students' high-level responses (Aloni & Harrington, 2018).

Interestingly, the study indicated the role-based discussion to be both their favorite feature and the one that participating students struggled with the most. Some students stated that it was difficult to play a moderator who carried out extensive work, and others acknowledged that it was challenging to play a role that contradicts their own opinions. There was also a comment that one person's late post delayed the entire discussion due to the small group size. Several students mentioned that it was hard to allocate time for smooth discussion, and this seems to be because all students had full-time jobs. The findings of this study indicate that students had positive perceptions of the proposed online board activity; however, they thought some modifications were needed for this activity to really work in online learning, such as rearranging role tasks and increasing group size.

Moreover, students' feedback on designing effective online discussions has been analyzed and summarized in this chapter. The summarized suggestions were largely about online discussion activity and three instructional strategies. First, all information related to online discussion activities is accurately and concisely organized and provided, and accessible at any time. This guideline document should include the purpose of the discussion activity, a list of

discussion topics, a list of related reading materials, definitions of roles and assigned tasks, useful examples, and a rubric for posting. In particular, there was an opinion that this document should be included in each discussion channel every week as a link so that students can access it conveniently.

Similarly, there was also a comment to create a one-page infographic containing only the key points about the posting-related rubric and roles and insert it as a link to each channel every week. Also, there were many opinions that it would be nice to specify the required articles while providing the entire reading list for the topic as it is now. Two to three were claimed as the desirable number of required reading materials. Most students thought that the weekly discussion was the most effective, but they addressed that it would be better to set the length of discussion to one or two weeks depending on the topic. In addition, there were many opinions that skipping the discussion would be more efficient when there is a major project or assignment. One interesting suggestion for nurturing a smooth discussion was to do a two-step posting: first answer the questions raised, then respond to other peers' posts in line with the chosen or assigned role.

Next, there were numerous suggestions regarding the tasks based on roles and the assignment of those roles. First of all, this study found that one moderator was doing too much work. In fact, there was a comment that some tasks of the moderator should be transferred to other roles or group members should do it together. For example, article choice should be decided by all members before the discussion starts, and it would be more appropriate for the summarizer to summarize the content of the target articles. It turned out that all four roles (i.e., moderator, summarizer, supporter, and challenger) were necessary for the quality discussion

and that no additional roles were needed. Since the moderator plays the most important role in initiating a discussion, many students asserted that this role should be assigned by the instructor. It was also mentioned that it is an effective practice for the students to choose their own roles according to the given topic. That policy could solve the issue many students raised that it is difficult to play a role that contradicts one's own views on a given topic. In particular, many students felt that the role of the challenger was equally critical as that of the mediator; perhaps due to the fact that the role of challenger helps improve the quality of discussion by bringing different perspectives on a given topic. One interesting finding is that role assignment restricted students' free thinking by forcibly urging them to play an assigned role for a given topic.

Students' perceptions of group size were also analyzed. Nine out of 14 students responded that 3-6 students per group were the most appropriate group size by claiming that the small group environment could promote students to have more opportunities to speak up about their opinions. The rest of the students answered from 6-10 would be a good size for the discussion group by stating that they have more diverse perspectives. The results suggest that students have different preferences when it comes to group size for discussion activities. Some students value a smaller group size for more opportunities to express their thoughts, while others prefer a larger group size to hear a variety of perspectives.

Last but not least, the results of the study showed that students generally found instructors' participation in discussions useful, good, and valuable, which is consistent with the findings of previous studies (Lesht & Schejbal, 2020; Mandernach et al., 2006; Mazzolini & Maddison, 2007). Instructor posts were found to provide students with professional feedback

that helped them gain a deeper understanding of the topic and positive reinforcement that helped promote student motivation to participate in discussions. In particular, students emphasized the importance of timely feedback, noting that delayed feedback is not conducive to learning at all. However, some students expressed their concerns that excessive instructor involvement can degrade interaction between students. As a result, the prevailing view was that instructors should aim for around 4-5 posts per discussion channel, providing timely and constructive feedback that supports, rather than dominates, ongoing discussions. Student feedback and collected data suggest that while instructor participation can benefit discussion activities, it needs to be carefully balanced to support productive discussions without overwhelming or driving students.

In particular, interesting aspects related to instructor participation were identified in the results of this study. Notably, Heuer and King (2004) introduced five specific roles of instructor for effective online learning: (1) planner, (2) modeling, (3) coaching, (4) facilitator, and (5) communicator, and these five roles were identified in this study. As a planner, the instructor created a document containing detailed explanations of the discussion activities and required work and distributed them prior to the start of the course, so that all students could familiarize themselves with the activities in advance. The instructor provided good and bad examples of posts according to four roles to help students quickly understand how to write appropriate posts. For instance, one student stated, "I think that's why the guidance structured the discussion well." Another student noted, "It works a lot. I like guideline like how to write a post about ... that kind of like description of the roles, they were very helpful."

The results show that in the proposed discussion activity, the instructor clearly planned the entire activity, and guided students to participate in the activity by providing model cases. The instructor acted as a coach by providing professional feedback, expressing compliments, and asking provocative questions. The instructor also served as a co-facilitator to back up the moderator(s) in each discussion group. The most typical example is when the moderator is absent or does not post a question; posting a guiding question helps the discussion proceed smoothly. According to the results of this study, many students found the instructor's guiding questions very helpful. Lastly, the instructor actively monitored each discussion group and provided timely support.

Feedback from students indicates that the five roles of instructors supported the discussion. In this study, the lead researcher could actively participate in the course as a TA and perform various roles in helping discussion activities. However, it may be difficult for instructors to recognize and perform these five roles on their own. Therefore, it is expected that clearly describing the five roles of instructors and providing them to instructors will be helpful in conducting effective discussion activities.

Research Question 2: How do Guided, Role-based, and Small Group Instructional Strategies Affect Peer Interaction in Online Discussion Board Activities?

The primary purpose of this study was to investigate whether guided, role-based, and small group instructional strategies could enhance student interaction using online discussion boards. To address this research question, it was crucial to examine and analyze the interactions that occurred among the participating students. Specifically, four types of data were collected and analyzed to answer Research Question 2: (1) online discussion board logs,

(2) online discussion board posts, (3) online survey responses, and (4) individual interview transcripts. This chapter specifically focused on reviewing the online discussion board logs and posts, along with student feedback on peer interactions, to confirm that meaningful interactions had actually taken place.

Table 8 shows that, according to the online survey results, students thought that they were able to interact effectively with their peers through discussion boards that utilized guided, role-based, and small group instructional strategies. The survey results showed that students found that engaging in conversations with peers within a given learning environment helped them improve their understanding of a topic. However, while students felt that the environment encouraged discussion participation to some degree, they did not feel that it was particularly conducive to developing a sense of community among students. In summary, the findings of the online survey indicate that the provided discussion board environment did facilitate interaction among students but did not have a significant impact on building a sense of community among them.

To obtain a more objective and comprehensive understanding of the study results, the researchers analyzed individual interview transcripts and discussion posts in addition to the subjective self-reports from online surveys. This approach aimed to examine whether authentic interaction among the students took place.

This study's results suggest that a majority of students consider peer interaction as crucial to online courses. According to the students, interaction with peers in an online contactless learning environment helps foster a sense of engagement and community that supports shared learning (Berliner & Calfee, 1996; Freeman, 2010; Sfard, 1998; Vygotsky &

Cole, 1978). Most students believed this approach was consistent with a social constructivist view of learning that emphasized the role of interaction and collaboration in building knowledge. By exposing themselves to the diverse perspectives and opinions of their peers or observing skilled peers, students could gain a deeper understanding of a particular subject and become active learners in a community for knowledge sharing or construction (Berliner & Calfee, 1996). In particular, some students emphasized that the proposed discussion board provided a hands-on environment in which they could actually connect and communicate with their peers online. It can be supposed that the proposed online discussion board facilitated social interaction as well as academic interaction among students. The findings of this study emphasize the importance of peer interaction in online courses and suggest that educators should focus on fostering meaningful interaction and collaboration among students. Doing so creates a supportive learning environment that fosters student engagement, a sense of community, and a deeper understanding of curriculum content.

Interestingly, the results of this study revealed that students had mixed feelings about the use of an online asynchronous discussion board. It turns out that the flexibility provided by the online asynchronous nature allowed students to participate in discussions at a convenient place and time, but there were often delays between discussions, making it difficult to maintain an ongoing conversation with their peers. It is possible that most of the students felt that the knowledge community was not sufficiently formed due to the constraints of continuous dialogue among students. However, most students still stressed that online asynchronous discussion boards are the best tool to support peer interaction in online courses. This is because asynchronous online discussions provide an opportunity for students to participate in

discussions on their own schedule, and they can read all saved discussion posts with multiple visits as needed, which helps to increase their understanding of the topic (Croxtton, 2014; Delaney et al., 2019; de Lima et al., 2019; Mensch & Ali, 2007; Ruane & Lee, 2016). The findings of this study suggest that asynchronous discussion boards are an effective tool for promoting peer interaction in an online course, despite some of the challenges they pose.

According to the interview analysis results, role assignments sometimes restricted students' free thinking and participation in the discussion process. Students often struggled to develop opinions as they played roles that contradicted their own views or were too obsessed with their roles to participate freely in discussions. For example, one student who played the role of summarizer said that he did not participate in the discussion and focused only on summarizing the discussion. In short, it is believed that role assignments limited interaction between students by forcing them into assigned roles. However, analysis of the collected discussion posts showed that more people interacted on a topic thread when the roles were assigned. Students felt that it was difficult to participate in discussion activities because they felt more responsibility according to their roles, but eventually actively participated in discussions to fulfill their roles, and as a result, it can be inferred that more interactions were made. In other words, role division fostered a sense of ownership and responsibility in students. Furthermore, as the importance of roles increased in small groups, they became important members of the group by participating more actively in discussions. This finding is consistent with the definition of learning from a sociocultural perspective (Lesht & Schejbal, 2020; Yilmaz & Yilmaz, 2019).

The interview results found that students had mixed feelings about the small group discussion. In a small group, students could follow the flow of discussion at any time due to the reduction in the total number of posts, and a sense of intimacy has developed between group members to share their opinions more, and furthermore, their understanding of the topic has also increased (Akcaoglu & Lee, 2016; Kim, 2013; Lesht & Schejbal, 2020; Martin & Bolliger, 2018; Qiu et al., 2014). These findings show that collaborative writing learning activities supported by online discussion boards are well aligned with the sociocultural perspective that cooperative learning activity encourages students to actively participate in the activity by facilitating the active sharing of opinions with peers in small groups (Motlhaka, 2020). However, the individual's contribution to the progress of the overall discussion was relatively increased. The discussion could not start due to the moderator's delay in posting, or the absence of the challenger resulted in a low-quality discussion with only one-sided opinions without critical perspectives. In other words, small groups sometimes had a negative impact on the progress and quality of discussions. However, this problem may be solved by providing guiding questions by the instructor or by slightly increasing the size of the small group to secure backup people.

An instructor also provided guiding questions starting in Week 9, and many students reported these questions helped guide their discussions. However, a review of discussion posts revealed no significant differences in student engagement, the persistence of engagement, and the number of students participating in discussion threads and posts attached to posts. It may be true that the guiding questions helped the students to progress the discussion smoothly, but it can be assumed that even without the guiding questions, the students made an effort to progress the discussion on their own. Based on student feedback on group size, the lead

researcher increased the group size from 4-5 to 8-9 in weeks 14 and 15, but the analysis of discussion posts showed no significant difference from the previous week. It is presumed that there was no big difference because students made efforts for smooth discussion, although there were difficulties due to increased responsibility due to the small group and insincere team members. In addition, since all of the participating students are graduate students, self-directed learning might be possible, and it is presumed that these difficulties were overcome well. One notable difference compared to the previous week was an increase in the number of students participating in discussion threads, likely due to a doubling of the number of available students.

The four factors defined in Table 5 were examined to determine if interactions actually occurred among students during the 15 weeks of the course.

The results of examining the weekly participation rates of individual students over a period of 15 weeks found no significant differences except for three cases in which the participation rates fell short of a satisfactory scale. However, the 9th and 13th weeks may have had a low participation rate due to the deadlines for major assignments. In particular, during the 15 weeks, the total number of posts posted by a student more than quadrupled from a minimum of 20 to a maximum of 90. This finding is consistent with previous studies, such as that performed by Caspi et al. (2003), indicating that a small number of students tend to contribute to most posts. It seems unreasonable to say that the participation rate of students was good only with the average participation rate. Therefore, there is a need to infer conclusions by examining other factors together.

In general, the consistency of student participation was somewhat unsatisfactory, as only five out of 15 weeks demonstrated satisfactory participation persistence (see Figure 12). Students with full-time jobs exhibited high levels of participation, mainly on weekends, which may have contributed to the overall inconsistency. The low persistence observed between approximately 6 to 10 weeks may have been caused by the delay of major assignments that were due before midterms and the arrival of final assignments. Specifically, the 13th week showed the lowest persistence of participation, which is thought to be related to the submission of major assignments at the end of the semester.

The number of posts related to a topic of discussion is an important indicator of student interaction. As depicted in Figure 14, satisfactory scores were observed throughout Week 15, and role assignments had a noticeable effect on increasing the frequency of interactions among students. In the first week without role assignment, it was the lowest at 2.53 points, but after role assignment was implemented, it maintained the early 3 points. This indicates that role division has a positive effect on the frequency of interactions between students. However, there was no significant difference in the frequency of peer interaction between the cases where four roles were assigned, and only two roles were assigned.

Interestingly, despite instructing students to select 2-3 articles to discuss prior to the start of the semester, 3-6 discussion threads appeared in the first week and 2-3 overall after roles were assigned. This indicates that role assignments motivated all students to focus on the given central topic each week and engage in conversation. In particular, Weeks 14 and 15 saw only two discussion threads despite the number of students doubling, suggesting that role

assignments limited the increase in the number of discussion threads and encouraged students to exchange more diverse opinions on one discussion topic.

The number of students participating in a discussion thread is another signal of peer interaction, as it indicates how much engagement is taking place in a discussion topic. Figure 13 shows that the total number of students participating in discussions consistently scored high on the scale between good and excellent. While the first week without role assignment had the lowest score of 2.47, implementing role assignment resulted in consistently high scores of around 3 points. This suggests that role assignments guided the structural order of the discussion and encouraged the participation of three or more students in one discussion thread.

The previous factors only showed whether students interacted, not whether students had meaningful interactions. To assess the level of meaningful interaction among students, the quality of posts was rated on a Likert scale ranging from 0 (lowest) to 3 (highest). Of the 1,044 posts collected, only 741 related to the assigned topic were included. The quality of posts was measured by how well students performed according to role tasks. Figure 15 indicates that significant and meaningful interactions occurred among students over the 15 weeks. Surprisingly, the study found that neither role assignment nor increasing group size had a significant effect on the quality of interactions. This may be because the participating students are graduate students and have prior knowledge of the related field and high-level writing skills. Also, the discussion guidelines provided were clear, so it may not have been difficult to write role-specific posts. Also, even if the group size was increased from 4 to 8 (from 5 to 9), the

number of uploaded posts did not increase significantly, so students could read fully posts without difficulty and write posts according to the roles.

In summary, the results of this study found that students who were provided with clear guidelines for discussion activities had meaningful interactions in small groups. In addition, role assignments allowed more than 3 students to fulfill their assigned roles, allowing them to share various opinions and enhance their understanding of the given topic. In addition, it was confirmed that the degree of participation in discussion activities and the persistence of participation were not related to the provided instructional strategies. Rather, it seems to have been influenced by the deadlines for major assignments or the student's full-time job status.

Additional Important Aspects

The primary purpose of this study was to explore how the application of guided, role-based, and small group instructional strategies to online discussion boards affect interactions among students. The analysis of the collected data provided sufficient answers to the main purpose. In addition, as a result of collecting and analyzing discussion posts uploaded by students, interesting results related to online discussion boards were revealed, which are summarized as follows.

Hidden, but Critical Roles in Peer Interaction: Responder, Simple Questioner, or Simple Answerer

Observation of students' posts on a weekly basis identified several hidden roles that were not included in the initially planned list of roles. One of the typical hidden roles was a responder who expresses his/her opinion on a topic-related question raised by a moderator or an instructor. In this study, most moderators chose target articles, read, and summarized them,

and posted target article list, summaries, and relevant questions. So, most of the students who were assigned the roles of supporters and challengers often played the role of responders who naturally answered questions that were posted (see Figure 16). After the first answer post was uploaded, supporters and challengers posted either agreeing or disagreeing with the post. Thus, this study found a structural problem in the proposed discussion activity environment in which supporters, challengers, and summarizers could not fulfill their role unless a post was uploaded in response to the question. Interestingly, it was revealed that although the role of the responder was neither described nor assigned, most students spontaneously posted their answers in the question post first, helping the discussion to flow smoothly.

Hello folks,
These are my thoughts:

Question1: what do you define learning?

Ambrose et al. (2010) define learning as a process that involves a change. This learning is generated by experience, and it opens opportunities for leveraging performance and future learning. I think Ambrose et al. (2010) provide an open definition of learning because learning is the acquisition of knowledge that is everywhere (formal and informal environments). I would like to think that learning is an opportunity to knowing new skills and values, and also relearn new ideas from others that surround us in a real context. That is why I align with Herrington et al. (2014) in their definition of authentic learning as a pedagogical approach that designs tasks that resemble real-life conditions because it aids learners in preparing for problem-solving situations and daily struggles.

Figure 16. Example of responder's post

Moreover, this study discovered that responders played an indispensable role in facilitating smooth discussions by linking moderators, supporters, and challengers. So, after the 2nd week, a notice was delivered to all students stating that they may play a different role if necessary to facilitate the discussion. Since then, outside of their assigned roles, students have

most often acted as responders, with occasional moderators, supporters, and challengers. Interestingly, the study found that moderators, supporters, and challengers were sometimes performed by students assigned other roles, but the summarizer role was almost exclusively performed by students assigned the summarizer role. This does not affect the smooth running of the discussion, even if there is no summary in the actual discussion, so it seems that the students did not do it voluntarily unless it was their role.

The screenshot shows a thread of three messages. The first message is from a user with the role 'Moderator' and contains the following text: 'FYI, I have a large assignment due on Sunday, October 28th, for another course. As a result, I will probably end up posting this week's article summaries on Tuesday. Apologies in advance for the delay!' followed by 'Update: article introductions are provided below - thanks for your patience!'. Below this message is an edit timestamp: 'Edited by [redacted] (https://iu.instructure.com/courses/2083042/users/6436275) on Nov 1 at 9:21pm' and a 'Reply' button. The second message is from a user with a profile picture containing '(http)' and a redacted name, dated 'Oct 30, 2022'. The text says 'No problem [redacted]! Thanks for the heads up.' followed by a 'Reply' button. The third message is from a user with a profile picture containing '(http)' and a redacted name, dated 'Nov 1, 2022'. The text says 'Yes, no worries [redacted] Could you just let us know which articles you're planning to summarize and ask us about so we can get a jump on reading? Thanks!' followed by a 'Reply' button.

Figure 17. Social interaction among students

In addition, there were questioners who asked their own questions about the discussion topic or course, or answerers replied to these general questions. It can be assumed that the provided online discussion board offered a social interaction environment allowing them to ask

and answer in the learning process. As shown in Figure 17, the student who was the moderator shared information about his late posting upload with the group members to communicate so that the discussion could proceed smoothly socially. These are posts unrelated to the presented topic, but they are important posts that can facilitate smooth discussion, foster intimacy and furthermore, build a sense of community among students. This study found that the online discussion environment provided played an important role not only in academic interactions but also in social interactions.

Dynamic Multi-Role Execution

Student1	Moderator	General			0
Student4	Challenger	General			0
Student5	Moderator	Moderator			2
Student1	Moderator	Responder			2
Student4	Challenger	Responder	Yes		2
Student5	Moderator	Supporter			2
Student4	Challenger	Responder			2
Student5	Moderator	Moderator			2
Student4	Challenger	Responder			2
Student5	Moderator	Supporter			2
Instructor	(co) Instructor	Summarizer	Yes		2
Student2	Supporter	Supporter			2
Student5	Moderator	Moderator			2
Student2	Supporter	General			0
Student3	Summarizer	General			0
Student3	Summarizer	Summarizer	Yes	1,2	
Instructor	(co) Instructor	General			0

Figure 18. Multi-role execution

In this study, it was evident that most students performed other roles in addition to the assigned role within the group. For example, in Figure 18, Student5 served as the assigned role, moderator for this group. Sometimes, however, they acted as responders, supporters, simple questioners, and responders. As such, students were found to be attempting to play multiple roles in order to respond dynamically to the flow of discussion within the group.

Question 1: Reading the design-based research (DBR) article, which used authentic e-learning principles as design guidelines for revising online courses. **Do you think that if we implement/take this line of work of revision by using these authentic e-learning principles as guidelines, it would improve the effectiveness of online courses in educational milieus? what are the affordances and/or constraints of doing this implementation work in all our online courses?**

My opinion: I think that conducting this kind of implementation in online courses would improve considerably a lot. It encourages professors to design authentic tasks instead of abusing the overuse of recorded lectures, artificial discussions, and didactic assessments. It also contributes to having a more learned-centered design (active learning) rather than traditional teaching.

Figure 19. New format for moderator's post

As mentioned above, in order to proceed with the smooth discussion, the role of a responder was required on the provided online board. Interestingly, several moderators posted the title of the selected article, the question, and their answer to the question in the first post, helping other students to immediately agree or disagree with the presented answer (see Figure 19). It was found that several moderators recognized the structural problems of the provided online discussion environment and uploaded posts in a new format as shown in Figure 19 to support the smooth progress of group discussions. In this format of moderator posts, supporters and challengers could immediately upload posts agreeing or dissenting with the opinions presented. This new post format exemplifies the positive effect that role assignments can have on students giving them a sense of responsibility and ownership in a group.

Importance of a Moderator's First Post in this Discussion

The results of this study show that the moderator's first post played an important role in the discussion activity. The findings found that a moderator's first post serves two essential

roles for effective discussion: (1) initiating discussion, and (2) determining discussion patterns.

A moderator's first post usually contains the following information: (1) list of two to three target articles, (2) summaries of the target articles, (3) questions related to each target article, and, additionally, (4) a moderator's own answers to the shared relevant questions (see Figure 20).

Role: Moderator

I decided to read three articles all discussing three different informal learning environments, all which I have experienced. These include the incidental learning environment within a profession, social media as a learning environment, and authentic learning environments through museum exhibits.

Incidental Learning Environments

Marsick and Watkins (2001) looked at informal and incidental learning environments. These types of learning environments are usually unstructured and many times go unnoticed to the learner. Learners within these environments are many times are adult learners within the work place through professional development, networking, coaching or mentoring, which can be beneficial to both the learners and their organization. However there can also be negatives due to the structure such as the learners becoming encompassed by their own needs, assumptions, and values within the situation (Marsick and Watkins, 2001). There needs to be more of a balance and clear intensions of learning environments for adult and nontraditional learners.

Questions

1. Can you share an example (as an adult learner) that you benefited in a way that was unexpected?
2. Have you been exposed to a learning situation that you did not know you were learning until afterward? If so, how did you respond?

Marsick, V. J., & Watkins, K. E. (2001). Informal and incidental learning. *New Directions for Adult and Continuing Education*, 2001(89), 25-34.

Social Media Learning Environments

Wade (2001) discusses the use of social media in education and the impact that this technology can have on students, highlighting direct quotes from learners and educators. While individuals are consistently on various social media platforms, is there a place for this within the education system? Many say that yes, "And the best tool available for teachers is social media itself. Only by being open-minded and using the technology themselves will they be able to really reach out to students" (Wade, 2001, pp. 3) However, there are has been situations where social media can influence false claims, information, and facts about important issues (Ghanem, et. al., 2020) Social media is not going anywhere and is the future "... no matter how strong the resistance, technological progress and new trends will eventually become a standard" (Wade, 2001, pp. 4) and educators need to adapt to the new standard.

Questions

1. What are the pros and cons to using social media in the classroom? Do you think that pros outweigh the cons, or vice versa?
2. If educators are only encouraged to use "institutional" platforms, how do they incorporate social media within their learning environment?

Lori Wade (2021). How Social Media is Reshaping Today's Education System. Georgetown University.

Ghanem, B., Rosso, P., & Rangel, F. (2020). An emotional analysis of false information in social media and news articles. *ACM Transactions on Internet Technology (TOIT)*, 20(2), 1-18. https://dl.acm.org/doi/pdf/10.1145/3381750?casa_token=sjbWJ-lFq1UAAAAA:wehIDgIQFA_uuwMwYMIfoIGbRXH9_p1700aE7kMtOctNVrbf96dBLHjGxLweb4UbLTGGzs3oeAHjMg

Figure 20. An example of the moderator's first post

The first post by a moderator is usually crucial in starting a discussion within a group in online courses. The moderator typically announces the start of the discussion and shares headlines of the articles to be discussed. Students tended not to participate in the discussion

unless the moderator uploads the first post. In summary, a moderator's first post played a key role in the opening discussion.

Role: Moderator

Hi Team,

I will be moderator this week. The topic of this week is " **Designing Effective Online Learning Environments**"

The first article from the readings I chose is

" 6. Joi L. Moore, Dickson-Deane, C., & Galyen, K. (2011). e-Learning, online learning, and distance learning environments: Are they the same? The Internet and Higher Education, 14(2), 129-135."

Summary:

This article mainly focuses on the concepts of e-Learning, online learning, and distance learning, and discusses their differences by terminology development and learning environment characteristics, and their application. For the differences, distance learning has more emphasis on geographical factors, e-learning often involves applications, objects, and websites, and online learning always includes technology's use in the process of learning. Besides, the article also discusses different learning environment characteristics such as self-paced, self-directed, and instructor-led. However, the authors also point out that the definitions and distinctions of these terms are not very clear and inconsistent, which influences researchers' study and designers on creating similar kinds of environments.

Question:

What are your thoughts on the terms e-learning, online learning and distance learning? If you need to design a learning environment for each learning type, what factors do you think should be considered? Are these factors for each one the same?

Figure 21. Example of the separated moderator's posts: the post of the first article

As shown in Figure 20, the discussion pattern form of the collected posts found that including multiple articles in a single post made it difficult for students to focus on one article (one topic), leading to the shallow discussion. On the other hand, it was shown that creating separate posts for each article, as shown in Figures 21 and 22, enabled more focused discussions and made it easier for students to find and participate in discussions on topics of interest. Despite initial guidelines, quite number of posts were still covering multiple articles. By emphasizing "one topic per one post," the instructor was able to increase the number of focused discussion posts. As such, the findings of the collected posts revealed the importance of the first post by a moderator in setting the tone and pattern for the entire discussion.

Role: Moderator

The second article I chose from readings is

"Jan Herrington, Ron Oliver, & Thomas C. Reeves (2003). Patterns of engagement in authentic online learning environments. Australasian Journal of Educational Technology, 19(1)."

Summary:

This article focuses on authentic activities. The authors firstly state that authentic activities have been widely used in different subject areas even though there are some problems or arguments about "authenticity"; and indicate the main research question is "the initial reluctance to willingly immerse in learning scenarios that some students experience, and the need for the suspension of disbelief before engaging in the task.". And then, the articles point out and discuss the concept and 10 characteristics of authentic activities such as real-world relevance, ill-defined, providing the opportunity to collaborate and reflect, and so on. What's more, by analyzing the data from interviews, the authors describe and consider "Willing acceptance and 'relief'" and "Delayed engagement" as two main patterns of engagement. Finally, the authors conclude that authentic learning settings could help students in the initial stages of learning and experience a suspension of disbelief.

Question:

Have you participated in authentic learning in your previous work or study experience? And if so, did the authentic learning you participated in include the characteristics of authentic activities mentioned in this article? If not, what do you think of the 10 characteristics of authentic activities mentioned in the article?

Figure 22. Example of the separated moderator's posts: The post of the second article


Bring Various Types of New Resources for Quality Discussion

According to this study, the summarizer was initially responsible for "bringing new resources," but regardless of their assigned roles, a quite number of students contributed diverse types of resources to bolster their arguments. Out of 1,044 posts, 235 (22.5%) incorporated new resources, indicating that students invested considerable time and effort in searching, selecting, arranging, and incorporating these resources into their posts. The uploaded new resources were also introduced in various formats.

The most common method to bring new resources to the discussion channel was link insertion, like Figure 23. Students brought new resources by inserting the intermediate link or creating a reference part.

██████████ (Challenger)

This is an easy for me as I have recently completed my agencies annual required trainings. I have taken these particular trainings for several years and I think they make a good example of the need for participatory design in the creation of a successful learning environment.

This is the [website](#)  that is used by a large part of mental health care workers in the state of Michigan. While it does provide trainings free of charge, I have found them to be lacking several of the characteristics discussed in the Gros article. The learning environment is very static, containing only sets of videos that cannot be rewind or fast forwarded which makes for a low-level user experience by not allowing the learner to search for a specific time stamp.

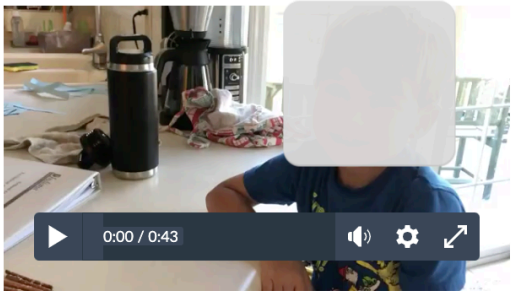
In it's assessment, the instruction does not offer what I consider to be appropriate feedback because it does not refer the learner to any specific area of the training material to correct their mistakes. In fact I would say that these trainings double down on their inappropriate feedback by forcing the learner to retake the entire module if they fail any one of its' multiple evaluations, resulting in several hours of commitment on the part of the learner.

Using Gros' 2 key issues of user participation in design and the providing of useful support, these trainings leave much to be desired.

██████████

Gros, B. (2016). [The design of smart educational environments](https://slejournal.springeropen.com/articles/10.1186/s40561-016-0039-x). *Smart Learning Environments*, 3(1), 1-11. Available: <https://slejournal.springeropen.com/articles/10.1186/s40561-016-0039-x>

Figure 23. Various types of resources: Reference link



██████████ your comments made me think about some of the games I number games I used to play with my son when he was little. I've attached a video of one of them I called "Pretzel Math". What you said about the educator participating in the design and learning process is imperative. Demonstrating to him that I was as engaged and enthused about the learning taking place allowed him to see that it was both fun, and productive. And there was definitely some constructivism infoled in this process as well as he was able to eat the pretzels at the culmination of the task. The consumption of the pretzels however was not depended on success or accuracy, simply the outcome of having an enjoyable math conversation with his old man.

Edited by ██████████ on Sep 18, 2022 at 3:34pm


 [1663437681.1620831.MOV](#)

Figure 24. Various types of resources: Video insertion

The next approach for introducing new resources involved the inclusion of videos. Videos were notable effortless and convenient to access by simply clicking the play button, attracting more students' attentions in comparison to text-based resources (see Figure 24).

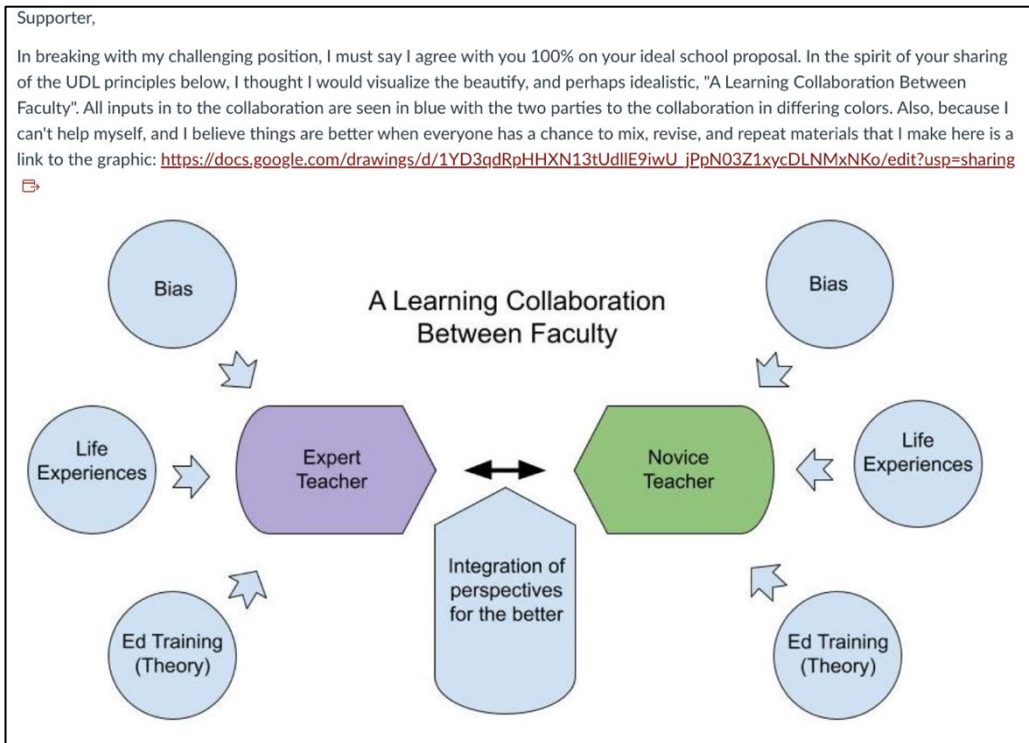


Figure 25. Various types of resources: Drawing

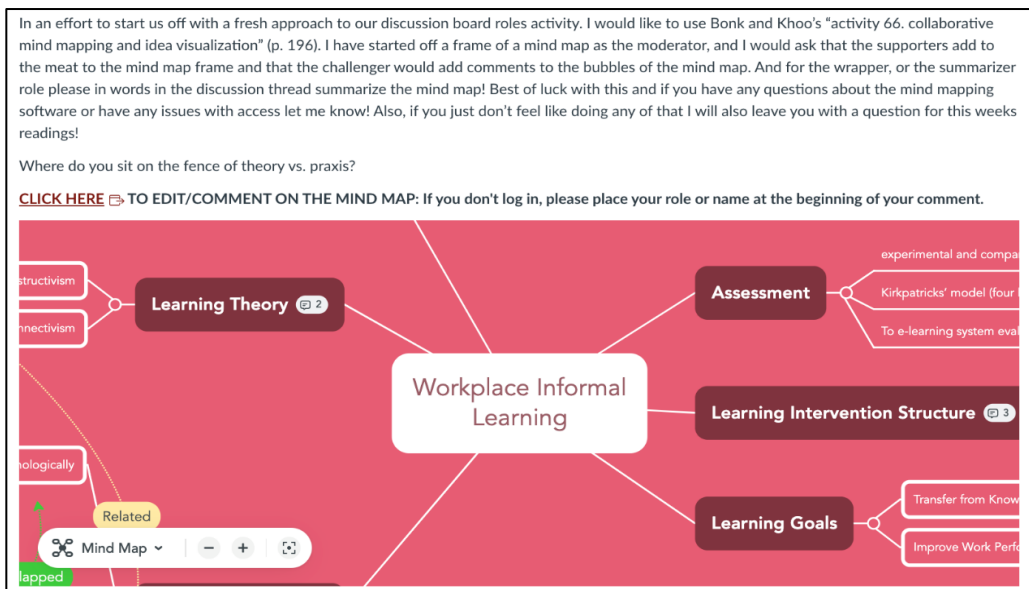


Figure 26. Various types of resources: Mind map

I think human-machine teaming or *augmented intelligence* can be effective because it leverages the strengths of the AI and the human being. This reminds me a little of our conversation in last week's discussion about how AI can't replace the teacher. The consensus there was that teachers and AI could work together, as discussed in the section on augmented intelligence from the newsletter. AI can take over the repetitious tasks and teachers can still maintain the human-human interaction that is so key to effectively personalized instruction.

Inclusive design is becoming a bigger deal at my workplace at Johns Hopkins University in designing asynchronous online courses for graduate engineers. We haven't focused much on providing access to our content in the technology/connection sense, but we've had a big push in making sure we design the instruction as best as we can for everyone everywhere.

[Quality Matters E³](#)™ is working on its next rubric edition for evaluating quality online instruction and inclusivity is top of mind for the committee producing the updated edition.

I also wanted to make sure we captured this inset from page 5 of the newsletter for our discussion on inclusive design. I thought this was very useful in better understanding some tenets of inclusive design.

TOP 5 Inclusive design for learning: creating flexible and adaptable content with learners

As educators, we help students discover, explore and value their own uniqueness, optimise their individual skills and differentiate themselves. To create flexible and adaptable learning experiences that are inclusive of student differences, consider the following five approaches:

- 1 SUPPORT MULTIPLE PERSPECTIVES**
Support unheard perspectives. We all make mistakes and have inner strengths, weaknesses and vulnerabilities. Recognising these commonalities fosters a dynamically resilient learning community. Create an environment of collective responsibility and respect, not competitive division.
- 2 VALUE MISTAKES AND UNCERTAINTY**
Encourage students to take risks and understand the value of productive struggle. Create environments that celebrate trial and error. Foster creative risk-taking through opportunities for students to redo work.
- 3 DESIGN INTEGRATED LEARNING EXPERIENCES**
Consider students who are marginalised or struggle, first and from the start. Integrating considerations for them results in education systems that can adapt

Figure 27. Various types of resources: Infographic

Some students also employed drawings (see Figure 25) as a means of introducing new resources. Drawings allowed students to effectively communicate their ideas and readers were able to grasp the essence of the post quickly and with ease. The mind map (see Figure 26) is a highly engaging and interactive technique that enables students to review the knowledge they have accumulated while also adding new insights. This method serves as an archive that can receive additional information and can be utilized efficiently for summarization purposes. The

last way of bringing in new resources is found in the infographic displayed in Figure 27. Rather than describe the lengthy and complex content using text, an infographic can lead to a rich and high-quality discussion by enhancing students' understanding.

Best Role Structure of Online Discussion Activity

Student12	Moderator	General			0	Hi Team,
Student13	Supporter	General			0	Which readings are
Student17	Peers from	General			0	I am the party crus
Student13	Supporter	Moderator			1	I love a party! Well
Student17	Peers from	Supporter			1	You are reading ah
Student13	Supporter	General			0	Thank you for
Instructor	(co) Instructor	General			0	Well said
Instructor	(co) Instructor	General			0	You know me...I lo
Student11	Challenger	Challenger			1	I am the challe
Student17	Peers from	Challenger			1	Higher Ed is all I d
Student12	Moderator	General			0	I apologize, Christi
Student14	Summarizer	Summarizer			1	Thank Geyan for jd
Student12	Moderator	Moderator		2,3,4		Hi Team, thanks fo
Instructor	(co) Instructor	General			0	Excellent post Chri
Student12	Moderator	Moderator			2	Question 1: Readir
Student11	Challenger	Challenger	Yes		2	Chris, I think you n
Student13	Supporter	Supporter			2	Moderator, you cou
Student14	Summarizer	Summarizer			2	This post focuses o
Student12	Moderator	Moderator			3	Question 2: Chapte
Student12	Moderator	Moderator			4	Question 3: In the
Student11	Challenger	Challenger			4	This is a great con
Student13	Supporter	Supporter			4	Supporter here, M
Student14	Summarizer	Summarizer			4	This post is mainly
Student14	Summarizer	Summarizer		1,2,3,4		Hi team,

Figure 28. Best role structure of online discussion activity

During a 15-week observation of discussion boards, several groups were found that were effectively discussed among students. The 5th week Session1C group shown in Figure 28 was one of the groups that followed the guidelines well and interacted efficiently. The moderator acted as moderator and responder at the same time by posting three posts containing both a summary of an article and questions and answers. Starting with the moderator's post, discussions were held three times in the pattern of supporters, challengers, and summarizers, and at the end of the discussion, the summarizer concluded the entire

discussion. It was confirmed that more than three people participated in about four to five posts in one topic thread. In addition, out of a total of 24 posts, excluding three posts by instructors, it was found that the participation of students was also high by posting approximately 5.25 posts per person. The discussion structure in Figure 28 can be referred to as the best format of role structure for effective online board discussions.

Limitations of the Study

Several limitations were identified in this study, and it is necessary to acknowledge and discuss these limitations in order to comprehensively understand the results of the study.

The first limitation to consider is that all participating students of this study had full-time jobs. This aspect holds the potential to influence the study's outcomes. In fact, several students expressed difficulties in promptly responding to posts due to their work commitments. Previous studies have also revealed that students with full-time jobs tend to be hesitant to actively engage in learning activities, such as online discussions, and often opt for online courses due to their flexible, self-paced nature (Gardner & Gopaul, 2012; Lesht & Schejbal, 2020; Moore et al., 2016). Therefore, this study's results may only apply to students enrolled in online courses with full-time jobs.

The second limitation related to the relationship between the lead researcher and the participants. The lead researcher worked as a teaching assistant for the target course for one semester during the course. This relationship between the lead researcher and the students might have influenced the results of the study. In particular, the lead researcher alone conducted personal interviews with 14 students, and this relationship might have led to more positive responses during the interviews. If another researcher had conducted the interview, or

if the interview had been conducted with another researcher, this risk might have been reduced, and the study validity slightly increased.

Finally, all qualitative data analysis except for the open coding of interview transcripts was performed by one researcher. To increase reliability, a rubric for analyzing discussion posts was first developed and graded accordingly, but the possibility of bias in the process of interpreting the results still exists. Reliability would have been increased if two researchers individually performed to assign rating-level on the discussion posts and then reviewed them together to determine the final rating levels.

Implication for practice

This study's findings suggest several key aspects for online learning instructional designers, instructors, and content developers. In particular, these suggestions can be useful when designing online discussions within graduate online courses for students working full-time or part-time.

Provision and convenient access of clear guideline

This study revealed that clear guidelines could help students engage in online discussion activities. It was shown that concise description of the purpose of the provided online discussion activity and what students are required to perform during a fixed period of time to achieve that purpose made students participate in the provided online discussion activity without confusion. In particular, it was shown that not only the provision of a clear guideline document but also the accessibility of the guideline, which can be accessed and referenced immediately, when necessary, is extremely important. In this study, although a detailed explanation of all the role-based discussion activities was offered, only a few students actually

reviewed the document through to the end. Therefore, in addition to simply providing clear guidelines, methods of inserting a quick reference link into each discussion channel or creating and inserting a one-page infographic have been proposed so that these guidelines can be easily accessed to all the students.

Flexible discussion schedule and frequency

According to the results of this study, most students reported having difficulty focusing on a discussion when they had major projects or assignments. It was also stated that some topics were so broad and complex that the discussion could not have been completed in a week. Based on these results, most students suggested that the discussion length be set to one or two weeks, depending on the topic, and that it would be effective to schedule discussion activities to avoid discussions when there is a major task.

Provision of guiding questions every week

Initiating discussion is the most essential task in discussion activities, and in this study, this task was assigned to a moderator. This study found that the moderator's late posting delayed the entire group discussion. To avoid this problem, during this study, the instructor offered guided questions related to the topic of the week in all discussion channels. By the end of the semester, many students addressed that these guiding questions were useful in encouraging other members to start a discussion, even if the moderators had not posted. It is necessary for the effective discussion activity that the instructor provided guiding questions to the discussion channel every week.

Two-step posting: answer question prompts first, then provide comments on other posts

According to the role structure proposed in this study, moderators' first posts were mainly summaries of and questions about selected articles. And, other than the moderator, other students naturally uploaded posts expressing their opinions on such questions. When moderators upload their posts, posts that answer questions are rarely seen. In other words, for the discussion to proceed naturally, posts with answers to the proposed questions must be uploaded. There were several opinions that it would be practical to post a response first, then upload a post supporting or criticizing another colleague's post. This two-level posting can be an effective and practical way to keep discussions running smoothly.

Provision of multiple options of posting

Some students suggested allowing students to upload different types of posts, including audio, video, infographics, and mind maps. Offering multiple avenues for posting can help students freely and quickly post based on their personalities, preferences, or accessible tools. In this study, there was also an opinion to record and upload voices easily because of busy work schedule. Therefore, the multiple options of posts can encourage students to participate more in the discussion.

Provision of a reading list with two options

Along with the full reading list, it may also be reasonable to provide students with two options: (1) read the articles recommended by the instructor and (2) discuss them together to determine two or three target articles. However, the materials that students decide on their own may not be enough to master the topic. Also, since two or three articles may not be enough to cover fully the assigned topic, it may be helpful to provide students with an

environment in which they can learn more about other reading materials in the course of the discussion through the instructor's participation in the discussion.

Discussion groups of four to six students

In this study, many students answered that 4-6 group members was the most appropriate number of students per discussion group. According to results of this study, this number can provide students intellectual intimacy while leading to in-depth conversation and allowing them to participate in discussions at any time with an appropriate number of posts. In addition, it was noted that each student's participation in the group becomes critical to the entire discussion, instilling a sense of responsibility. As a result, it was suggested to form a discussion group with four to six students.

Assignment of a moderator and free choice of remaining roles

The moderator plays the most crucial role in discussion activities by leading and mediating the discussion and leading the discussion smoothly. Therefore, the amount of assigned work was rather high, and most students found this role more difficult than others. However, while serving as moderators, students could actively participate in the discussion, increasing their sense of responsibility and understanding. Therefore, the most reasonable role assignment to help all students experience this learning is for the instructor to appoint a moderator and the rest of the students to choose one among the other three roles, supporters, challengers, or summarizers. At this time, except for the moderator, students can freely choose their roles depending on whether they agree or criticize the writings of other colleagues.

Instructor's timely feedback

The results of this study indicate that the instructor's participation in the discussion was helpful to the students. The instructor's method of participating in the discussion suggested in this study was to post four to five posts per discussion channel and provide immediate responses to students' postings or questions while the discussion is in progress.

Implication for Research

The findings of this study have presented several implications for future research.

First, in order to generalize the research results, this study can be expanded to additional online courses and more organizations. For example, a study can be conducted with more online courses such as those provided by other departments of this university or by targeting online courses outside this university. By increasing the sample size and widening subject type, greater generalization of the results might be possible.

Second, this study was performed with graduate-level online courses. Interestingly, all the students who participated in this study had full-time jobs. Therefore, it would also be meaningful to determine how the results differ when this study is conducted with online courses taken only by full-time students and online undergraduate courses.

Third, this study collected and analyzed only students' perspectives on the proposed online discussion activities. Therefore, gathering and analyzing the feedback of instructional designers or content developers who design these online discussion activities or instructors who apply these discussion activities to the actual learning environment can be helpful in understanding and identifying any efficiencies or shortcomings of the discussion activities.

Finally, other methods or tools that facilitate peer interaction, such as group projects, pair projects, peer discussions, or peer reviews, need to be explored. By comparing the results of this study with the current study, it might be possible to find out which methods are most effective. In addition, ferreting out the advantages and disadvantages of various methods used to promote peer interaction in online courses can be an important guideline when applied to actual educational environments.

Conclusions

This study explored how online discussion board activities with guided, role-based, and small group instructional strategies affect interactions among students based on students' perceptions of participating in the provided online discussion activities.

The results of this study indicate that students had both positive and negative perceptions of the three instructional strategies used in online discussion activities. First, role-based discussions were considered beneficial for encountering diverse opinions and fostering a sense of ownership, accountability, and community. Second, small group discussions led to increased participation, reduced total number of posts, and more intimate interactions among students. This resulted in increased individual contributions and a greater sense of responsibility. Third, clear and detailed guidelines provided by an instructor helped students to understand the purpose of the discussion activity and how to engage with it. In particular, an instructor's guiding questions supported students in understanding the given topic better and acted as a backup discussion initiator in case of moderator delay.

The findings of this study also revealed challenges that students encountered in role-based and small group discussions were identified. Late posts from one student were found to

hinder the entire discussion potentially, and there were situations where students had to take on a role that went against their personal opinions. Although providing clear guidelines, explanations, and examples for each role was deemed helpful for understanding the discussion activities, it was found to be difficult for students to access them quickly and conveniently when needed.

The study's findings show that the use of three different instructional strategies in online discussion activities provided an environment in which students could interact with each other in a meaningful way. The students participated satisfactorily throughout the 15-week period but tended to participate more on a specific day, which may have been due to their full-time jobs. The participation rate was lower during weeks when major homework assignments were given. Assigning specific roles to students helped them to take responsibility and fulfill their duties, leading to more students participating in fewer discussion threads. In summary, the study found that online discussions with instructional strategies can promote student interaction, but factors such as job status and homework assignments can affect participation rates. Assigning specific roles to students can increase participation and encourage them to take responsibility.

Finally, the findings of this study suggest several practical solutions for designing effective online discussion board activities. First, all members should decide on the target article through a brief meeting or online chat before the discussion starts, reducing the moderator's job burden. Or an instructor might provide two or three required articles on the entire reading list. Second, an instructor appoints a moderator every week, and the rest of the students participate in the discussion by deciding their roles according to their views on the

topic of discussion. Third, an instructor should create and provide clear guidelines for discussion, and, at the same time, links all channels every week for quick reference anytime, anywhere. Also, to prevent delays in discussion due to moderators' late posts, guiding questions should be shared across all channels. Fourth, the discussion period is set for one or two weeks depending on the proposed discussion topic, and the week with the main assignments may be skipped. The discussion schedule is prepared in advance and distributed to all students before the start of the semester. Fifth, all students except the moderator write the first post to answer the presented question and the second post according to the role. Sixth, an instructor may provide other post-upload formats, such as video and audio. Seventh, an instructor may designate a discussion group consisting of four to six people for an effective discussion environment. Finally, an instructor should regularly monitor all discussion channels and provide timely feedback on student posts.

This study presented several interesting and useful findings for effective discussion. It was found that the role of the respondent to answer the questions raised and the role of the simple questioner and respondent to proceed with the discussion were necessary. In particular, the results of this study revealed that students actively play multiple roles for smooth discussion. In addition, it was found that the moderator's first post led the whole discussion and, at the same time, played an important role in setting the pattern of the whole discussion. Besides, students actively introduced various types of new resources to support their views during the discussion process. Finally, this study found an optimal discussion pattern for efficient role-based online discussion. For example, the entire discussion happened as follows:

(moderator-supporter-challenger-summarizer)-(moderator-supporter-challenger-summarizer)-
(moderator-supporter-challenger-summarizer)-summarizer.

The results of this study cannot be generalized because of the small sample size. However, the findings of this study revealed that three widely used instructional strategies, (1) guided instruction, (2) role-based discussion, and (3) small group discussion, had a positive effect on actual online discussion board activity. These findings suggest practical and actionable tips for instructional designers, content developers, and instructors who want to design online discussion boards that promote peer interaction in online courses. Additionally, the findings can serve as a basis for large-scale investigations and data modeling in the study of designing online discussion boards to facilitate peer interaction. In summary, although the generalizability of the results of this study may be limited due to the small sample size, the results provide useful insights for designing effective online discussion boards.

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Appendix A

Online Survey

The Use of Guided, Role-based, and Small Group Discussion Board to Facilitate Peer Interaction
in Higher Education Online Courses: Students' Feedback Survey

IRB Protocol #15787

Hello,

I am studying the use of guided, role-based, and small group discussion boards to facilitate peer interaction in IST online courses. The primary purpose of this survey is to gather student feedback on the use of guided, role-based, and small group discussion boards as tools to support peer interaction in online courses. Thank you very much for taking part in this important survey. Your answers and perspectives will be used to explore the pros and cons of using discussion boards with the three instructional strategies provided to facilitate peer interaction in online courses. Furthermore, your opinions on improving discussion boards to effectively facilitate peer interaction are also sought. More importantly, your responses will be kept confidential and shared in aggregated form only with our team.

This survey consists of 4 basic questions about you and 13 5-scale Likert-style questions and 1 open-ended question regarding this study. This survey takes less than 10 minutes to complete. I will not collect any identifiable information including your email address and only gather the aggregated responses. Your honest responses to the provided questions will be helpful in developing the results regarding the use of guided, role-based, and small group discussion

boards as tools to support peer interaction in online courses. If you have any problems, questions, or concerns, feel free to email me (sunseol@iu.edu).

Thank you in advance for your time!

From Sunmi Seol

Student in Ed.D. in the IST

Basic Student Information

This section collects basic information about you. If not, select “*Decline to answer*” and move on to the next question.

1. What is your gender?

Mark only one.

- a. Female
- b. Male
- c. Decline to answer.

2. What is your race?

Mark only one.

- a. White/Caucasian
- b. Hispanic or Latino
- c. Black or African American
- d. Native American/First Nations/Pacific Islander
- e. Asian

- f. Decline to answer.
3. What is your major?

Mark only one.

- a. M.S.Ed. in Instructional Systems Technology (Residential)
 - b. M.S.Ed. in Instructional Systems Technology (Online)
 - c. M.S.Ed. in Educational Technology for Learning (Online)
 - d. Ph.D. in Instructional Systems Technology (Residential)
 - e. Ed.D. in Instructional Systems Technology (Online)
 - f. Graduate Certificate in Instructional Systems Technology (Online)
 - g. Graduate Certificate in Online Teaching and Learning Practices (Online)
 - h. Undergraduate License Addition in Computer Education
 - i. Ph.D. Minor in Instructional Systems Technology
 - j. If none of the above applies to you, please write here.
-

4. Do you have full-time jobs?
- a. Yes
 - b. No
 - c. Decline to answer.

Peer Interaction-related Questions

This section collects your feedback on your peer interactions using the provided discussion board. Choose the scale from 5 (Strongly agree) to 1 (Strongly disagree) about the following sentences:

1. I was able to communicate with peers in this discussion board.

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

2. I was able to share any opinions/views/thoughts with peers in this discussion board.

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

3. I was able to clearly read and understand peers' posts in this discussion board.

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

4. I was able to organize my thoughts and leave a comment after reading peers' posts in this discussion board.

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

5. Conversations/discussions with peers helped me better understand the give topic/problem/prompt in this discussion board.

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

6. I think there was a sense of community with peers using this discussion board.

1 2 3 4 5
Strongly disagree Strongly agree

7. This discussion board encouraged me to actively participate in the discussion.

1 2 3 4 5
Strongly disagree Strongly agree

Online Discussion Activity-related Questions

This section collects your feedback on the provided discussion board. Choose the scale from 5 (Strongly agree) to 1 (Strongly disagree) about the following sentences:

1. I was satisfied with this discussion activity.

1 2 3 4 5
Strongly disagree Strongly agree

2. I think the quality of this discussion activity was good.

1 2 3 4 5
Strongly disagree Strongly agree

3. I gained more interest in the topic of this discussion activity.

1 2 3 4 5
Strongly disagree Strongly agree

4. I feel that this discussion activity served my needs well.

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

5. I would like to participate in the similar discussion activity in the future.

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

6. I would like to recommend this discussion activity to another student.

	1	2	3	4	5	
Strongly disagree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Strongly agree

Feel free to share any comments/feedback/suggestions regarding the use of the discussion board for promoting peer interaction.

We will conduct individual interviews at the end of the course to gain a deeper understanding of what students think about the online discussion activities provided. If you participate in this study, you will receive a \$20 Amazon gift card. If you are interested in an individual interview,

please send your contact information to me at 650-644-6049 or sunseol@iu.edu. Or click the below checkbox and leave your email address.

Yes. I want to participate in an individual interview.

Enter your email _____

Your participation will greatly benefit this study.

Survey Completed

Thanks for completing the survey! Your answers will be saved and used for internal study only.

Appendix B

Study Invitation Email to Instructors

The Use of Guided, Role-based, and Small Group Discussion Board to Facilitate Peer Interaction
in Higher Education Online Courses

IRB Protocol #15787

Dear (an instructor's name),

Hello!

My name is Sunmi Seol, an EdD student in the IST Program at Indiana University Bloomington. I would conduct a dissertation **investigating whether combining three educational strategies in online discussion boards: guided, role-based, and small group discussion, promotes peer-to-peer interaction in graduate online courses.**

IST graduate online courses were selected who were willing to use the online discussion board to conduct this study, and your course would be a good fit. In this study, data will be collected from students' posts saved on online discussion boards, online surveys, and individual interviews. **So, I would like to ask for you to participate in this study as a collaborator.**

As a collaborator, you will be asked to join me in **designing an online discussion activity** for this (course title). During the study period, you may be asked questions about the (course title) or request assistance with this research. For example, you may be asked to send forwarded emails to all enrolled students to ask if they would like to participate in a study. You may also be asked to share IU emails of enrolled students or student mailing lists of courses to send students online surveys.

Please reply to this email if you would like to participate in this study. I really need your help in conducting my dissertation. If you have questions or request a study information sheet, please contact me at 650-644-6049 or sunseol@iu.edu. If you need more information about this research, I can send my proposal to you.

If you have any adverse effects or concerns about the study, please contact the lead researcher (sunseol@iu.edu) or contact the IU Human Research Protection Program office at 800-696-2949 or at irb@iu.edu. This research is approved by the Indiana University's IRB under protocol number #15787.

Thank you for your consideration!

Best Regards,

Sunmi Seol

EdD student in IST Department

Appendix C

Interview Protocol

The Use of Guided, Role-based, and Small Group Discussion Board to Facilitate Peer Interaction
in Higher Education Online Courses

IRB Protocol #15787

We provide the interview protocol used for semi-structured individual interviews.

Before interview:

- Check the internet connection.
- Check if Zoom works, and check if Zoom recording works well.

The interview starts with the following:

- Say “thank you” for your participation.
- The introduction of an interviewer
- The overview of this project, including the study goal
- Provide **Consent Form**: if already given, skip this
- State that the entire interview is video recorded.
- State that there are no correct or wrong answers.
- State that the participant will receive a **\$20** Amazon gift card.

Introductory

Hello, thank you very much for participating in this individual interview today. My name is Sunmi Seol, and I am currently a student in the EdD program. This interview is for gathering

data related to my dissertation study. Before the interview begins, I briefly explain the goal of this study.

- ***The goals of this study:*** This study examines whether a combination of three instructional strategies applied to online discussion boards: guided, role-based, and small group discussions promote peer interaction in graduate online courses. In addition, this study aims to investigate students' feedback on using the discussion board to which three teaching strategies are applied.

Applying three instructional strategies: guided, role-based, and small group discussions, I would explore your experiences with targeted online courses, *R622-Learning Environment Design*, to develop general themes about peer interactions with the newly designed online discussion board. As an interviewee, you have the right to ask questions at any time, to decide not to answer some questions, to receive a copy of the interview transcripts (results, if requested), and to discontinue the interview at any time. Your answers will be kept confidential. You may already know that your responses will be treated confidentially, subject to the informed consent provided.

- Check whether a participant has any questions about the interview.
- Explain the video recording of the interview and participants' rights regarding this. Once participants have agreed to the interview being recorded, turn the Zoom recording on and note that it is now on.

- Further check on questions; if none, start an interview.

Topic Domain One: Peer Interaction using a Discussion Board

You are taking *R622-Learning Environment Design* in Fall 2022. Among the learning activities offered during the semester, you were asked to participate in a group discussion board activity.

Is that correct? From now on, I will ask you about the peer interactions you have experienced through the discussion board activities provided to you.

Main questions:

- What did you like about interacting with your peers (classmates) in the provided discussion activity? And why?
- What was the most challenging part of interacting with your peers (classmates) in the provided discussion activity? And why?
- What would you suggest as a way to improve peer interaction on the provided discussion board? And why?

Additional questions:

- Do you think peer interaction is necessary in online learning? The reason is that? If not needed, why?
- If you think peer interaction is beneficial to learning, what is the best tool or approach to support peer interaction in online course?

Thank you for your answers to the topic domain one. Now we are moving to the topic domain two, online discussion board activity provided in the *R622-Learning Environment Design*.

Topic Domain Two: Online Discussion Board Activity

You were asked to participate in a discussion activity using the online board each week while taking (*R622-Learning Environment Design*) this semester. In this domain, you will be asked about your experiences with online discussion activities.

Main questions:

- What did you like about the provided discussion activity? And why?
- What was the most challenging part of the provided discussion activity? And why?
- What would you suggest regards to improving the provided discussion activity? For example, what would you change in this activity to make it more effective or engaged?

Advanced questions:

Three instructional strategies (guided, role-based, and small group) were applied to the provided online discussion board.

- Do you think that the application of the three instructional strategies was helpful for online discussion activities? If so, why? If not, why?
- As for **guided** instructional strategy, what worked well and didn't work?
 - What information do you think should be provided to guide students in online discussion board?

- As for **role-based** instructional strategy, what worked well and didn't work?
 - What roles would you assign for an effective online discussion? And why?
 - What role do you think is the most critical in online discussion? Why?
 - Which do you think is more effective, role assignment by an instructor or free role selection?
- As for **small group** instructional strategy, what worked well and didn't work?
 - What do you think is the group size for an effective online discussion? Why?
- As for **reading materials**, how many articles do you think are appropriate for reading and discussing effectively in a week? Why?
- Do you think **instructor's active involvement** in online discussion is helpful? Why? If not, why?

Lastly, if you have anything to share, feel free to speak up.

Closing

I really appreciate your help with this study. As I mentioned before, your name will be replaced with a pseudo name, and your responses will be confidentially treated and saved on a password-protected computer. If you have any questions regarding this study, feel free to contact me, Sunmi Seol, at 650-644-6049 or sunseol@iu.edu.

Appendix D

Participant (Student) Invitation Email

Dear R622 student,

Hello!

My name is Sunmi Seol, an EdD student in the IST Program at Indiana University Bloomington. I am currently conducting a dissertation investigating whether combining three educational strategies in online discussion boards: guided, role-based, and small group discussion, promotes peer-to-peer interaction in graduate online courses. The (course title) you enrolled in was selected as a target course with the consent of your instructor, and you were classified as a potential participant. So, I would like to invite you to participate in this study.

As a participant, you will be asked to participate in an online student survey and personal interview two weeks before the end of the semester. The online survey takes approximately 10 minutes to complete and will not collect personal information. The personal interview will be conducted for students who express their intention to participate and take about 45 to 60 minutes.

There is no reward for participating in online surveys, but you will receive a \$20 Amazon card for participating in individual interviews. Your participation will be an invaluable addition to this study, and your findings may lead to a greater understanding of the use of the three instructional strategies to promote peer interaction in online discussion activities.

The potential risks with this study are minimal. You may feel uncomfortable while answering online survey questions. While filling out the survey, you can skip questions you feel uncomfortable with or do not want to answer.

Participation is voluntary. You can choose not to take part in this study. If you decide to participate, you can change your mind later and leave the study at any time. You will not be penalized or lose any benefits if you choose not to participate or leave the study later. Please reply to this email if you would like to participate in this study. If you have questions later, don't hesitate to contact me at 650-644-6049 or sunseol@iu.edu.

If you have any adverse effects or concerns about the study, please contact the lead researcher (sunseol@iu.edu) or contact the IU Human Research Protection Program office at 800-696-2949 or at irb@iu.edu. This research is approved by the Indiana University's IRB under protocol number #15787. Thank you for your consideration,

Best Regards,

Sunmi Seol

EdD student in IST Department

Appendix E

Online Discussion Board Manual

Role-based Small Group Online Discussion Activity

Descriptions

This learning activity is to help students interact with their peers in this course. This activity is based on collaborative learning and constructivism, where students learn and grow together while thinking and talking about common topics without feeling alienated or disconnected.

Objectives

The objectives of this activity include the following:

- To understand the questions presented and peers' posts.
- To understand and perform the required tasks according to the assigned role.
- To write a post according to the rubric and guidelines

Overview

This is a small group role-based asynchronous learning activity for 15 weeks. The first week is a tutorial period, where you learn the basic rules and participate in discussion activities, and practice discussion. During the remaining 14 weeks, students engage in assigned group discussions. In a discussion group consisting of four students, they perform one of four roles: **moderator, supporter, challenger, and summarizer**. Assign four students to a group, assign them different roles, and have them engage in a weekly discussion activity. Students will perform all four roles within the same group for four weeks. At the end of this session, students

will be assigned to a new group and conduct role-based discussions. Group assignments and weekly role assignments are posted in bulk once every four weeks.

Outline

Tutorial: 8/21/22 – 8/27/22 (1 week)

Students will be able to explore two resources, guidelines, and a tutorial video regarding an online discussion activity and practice creating a conversational post.

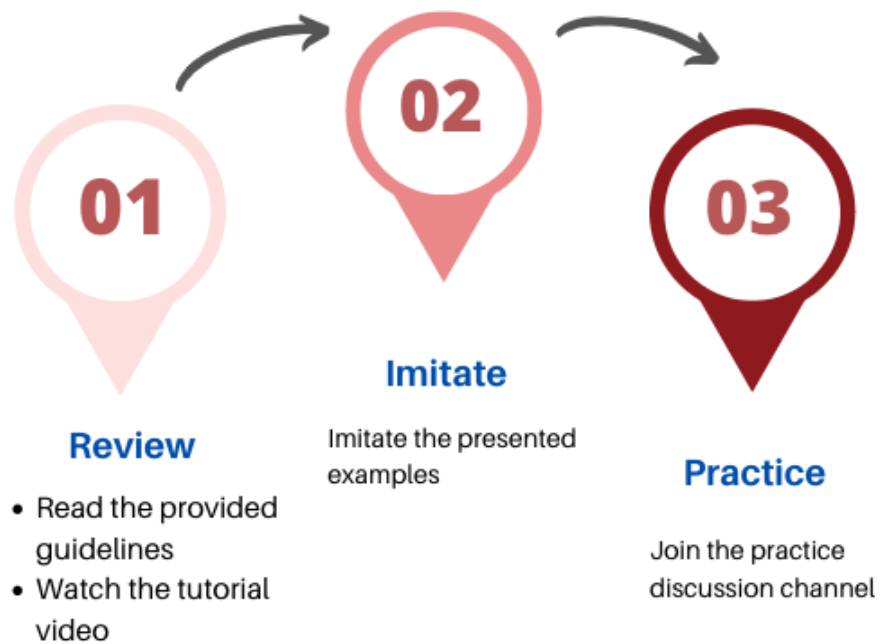


Figure 1. Tutorial Outline

Discussion Session: 8/28/22 – 12/5/22 (14 weeks)

Students will participate in 14-week discussion activity: one week is one discussion week and four-week is one discussion session. Students will perform three processes in Figure 2: (1) check

my group and my role and learn the required tasks, (2) check the required reading materials and read them, and (3) join the assigned discussion channel and read peers' posts or upload my posts.



Figure 2. Discussion Week Outline

Roles

Several tasks required for effective online discussion are assigned to four roles (**moderator, supporter, challenger, and summarizer**). Tasks and examples for each role are as follows.

Moderator

A moderator's role is to provide a clear direction of discussion and motivate students to participate in the discussion actively.

Responsibility	Corresponding task	Example

Support the continuity of discussion	Introduce the topic/questions/prompts	“This week, we talk about learning theory and learning environments...”
	Give a clear direction	“First, we define what learning is and discuss the various learning theories. After that, we discuss various scholars' opinions and share our thoughts on the design of the learning environment.”
	Provide immediate response to requests for help	“Emily, for a detailed explanation of the traditional view of learning, see pages 3-7 of the book by Bransford et al.”
	Identify bottleneck/conflict and provide the guidance	“Before studying the theory of learning in detail, it would be good to understand and define exactly what learning is.”
Encourage participation in discussions	Mention the names of students not participating in the discussion	“Hi Tom, did you say you are currently teaching math in elementary school? What is learning from the perspective of a math teacher?”
	Respect all students' ideas	“All members well defined and shared what learning was based on their professional backgrounds. We could see the learning from different perspectives and better understand

		what learning is based on common characteristics. Thank you all so much.”
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Supporter

A support’s role is to reply to all the posts and comments from a positive view, bring a new idea, and use a theory.

Responsibility	Corresponding task	Example
Reply to all the posts and comments from the positive view	Show agreement with the supporting details	“Matt, I agree that learning can happen in both formal and informal settings. Students can learn by reading blog posts or discussing specific topics on discussion boards.”
	Reply to the presented question	“Technology advancements have overcome the limitations of the learning environment, and now students can learn anywhere at their own pace. In particular, I think that the development of mobile technology has brought ubiquitous learning. Therefore, when designing a learning environment, I think technology is essential.”

	<p>Provide positive feedback to the post</p>	<p>“Tom, you pointed out the important role of technology in the learning environment. That's a very critical point we should consider at this moment. Thank you!</p> <p>Without technological advances, people would not be able to overcome the limitations of time and space in learning. In particular, the example of informal learning where you could read a paper from anywhere using a mobile app also helped me understand informal learning.”</p>
<p>Support discussion</p>	<p>Help expand the current topic by bringing in sources</p>	<p>“Emily, you mentioned that from a sociocultural point of view, learning happens as people interact with each other and their environment. Like you, Hickey (2020) argues that knowledge's origin lies in people's interaction with the social and material world. From this point of view, we must consider how culture plays a role in the learning process.”</p>

	<p>Invite peers to a discussion by asking a question</p>	<p>“Tom, I agree. YouTube is a good platform for watching good courses for free. I think it is a good example of informal learning. However, since there are many interesting contents besides educational content on YouTube, learners can easily be interrupted in their learning. These are the challenges of informal learning. In this regard, informal learning seems to require more self-discipline of learners. Tom, what do you think?”</p>
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Challenger

A challenger’s role is to reply to all the posts and comments from the negative view, bring a new idea, and use a theory.

Responsibility	Corresponding task	Example
<p>Reply to all the posts and comments from the negative view</p>	<p>Show disagreement with the supporting details</p>	<p>“Jessica, your opinion makes sense that informal learning can adversely affect learning. However, informal learning has various benefits. We can learn without being limited by time and space and study according to the learner's learning style. Therefore, I think that informal learning is more likely due to the absence of the learner's control ability rather than a negative effect on learning.”</p>

	<p>Reply to the presented question</p>	<p>“Technology should be considered when designing the learning environment. A learning environment using technology can increase learning effectiveness. For example, rather than just memorizing words, you can quickly memorize many words in a fun way using a mobile word game.”</p>
	<p>Provide negative feedback to the post</p>	<p>“Emily, your perspective on learning seems to overlook the fact that humans are autonomous animals. Of course, the most fundamental learning is to absorb the object of knowledge. However, it should be considered that the quantity and quality of learning that each individual learns will vary even if they study with the same learning content.”</p>
<p>Support discussion</p>	<p>Help expand the current topic by bringing in sources</p>	<p>“Simply put, inclusive education is about learning together. However, the different conditions of the learner significantly affect the learning effect. Therefore, it is necessary to support various learners. One of the most common pedagogical theories is Universal Design for Learning (UDL)</p>

		(Hall et al., 2012). This theory is characterized by providing learners with a variety of options.”
	Invite peers to a discussion by asking a question	“Emily! You asserted that mobile technology should be actively incorporated into learning. Of course, mobile technology overcomes the limitations of time and space and enables learning anytime, anywhere. However, mobile technology is expensive. Learning content using mobile technology can be accessed in low-wage families or underdeveloped countries. Instead, it can increase inequity in education. Emily, what do you think we need to do to bring mobile technology to underdeveloped countries?”

Summarizer

A summarizer’s role is to summarize one discussion thread, wrap the entire discussion week, and draw the conclusion every week. Additionally, you can bring in a new source to help students clearly understand the whole discussion.

Responsibility	Corresponding task	Example
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<p>Summarize key ideas (support the continuity of discussion)</p>	<p>Merge two different ideas (views)</p>	<p>“There were two different views of the teacher's role in the learning process. One is a role as a source of knowledge, and the other is a role of learning with learners as a coach. The difference in this role is due to the perspective that defines learning differently, and it can be defined as a role that helps the learning process from a comprehensive point of view.”</p>
	<p>Organize and share important ideas in one thread</p>	<p>“Multiple opinions were presented about the role of technology in learning, especially the media. The educational use of media has advantages and disadvantages. However, what is more important is whether the advantages of the media are maximized, and the disadvantages are minimized. Therefore, it is necessary to think about an application method that can enhance the benefits of media.”</p>
	<p>Presenting the relations between the proposed idea and the topic</p>	<p>“The teacher's role as a coach, as suggested by Emily, is in the same vein as the new paradigm in learning. The teacher is no longer a medium to deliver knowledge as a source of knowledge but a coach who guides and helps learners to create</p>

		<p>their own knowledge while interacting with others within a given source. The change in the role of the teacher also implies a change in the definition of learning and the role of the learner.”</p>
Draw conclusion	Combining and presenting all members’ ideas	<p>“Taken together, all members agreed to the use of media for educational purposes. Furthermore, it was agreed that a practical approach is needed to minimize the media's shortcomings.”</p>
	Leading the final conclusion agreement of the members	<p>“Most agreed that guidelines for students and the active participation of teachers and parents are also necessary for the educational use of media. Tom, what do you think?”</p>
	Presenting the final conclusion clearly	<p>“To summarize this week's topics and discussions, the effective use of media has a positive effect on educational outputs. However, excessive dependence and addictiveness of media can actually hinder education. Therefore, it is necessary to train students to learn through media use with clear guidelines and active participation of teachers and parents.”</p>

Wrap up the week	Finish the week with closures	<p>“This week we discussed what learning is. Thank you for sharing your thoughts and experiences of learning. It was nice to be able to share different perspectives on learning. This week is over, and next week we will discuss various theories and examples related to learning environment design.</p> <p>Thank you all of you! See you next week.”</p>
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Writing a conversational post

A post in this discussion activity serves as a medium to facilitate student interaction. For effective peer interactions, you need to know the following:

- All groups will be re-assigned on **Sundays** once **every four weeks**.
- All roles will be re-assigned to students **every Sunday**.
- Once a group is appointed, they will conduct discussion activities together for **four weeks**.
- One discussion week runs from **Monday** to **Sunday**
- When writing a post, **write your role** at the top.
- Each post can be up to **300** words long; **100-200 words** are appropriate.
- Each post typically covers or addresses **one topic but sometimes additional ones**.
- Upload around **three or four posts** every week, sometimes more if you get highly engaged in it.
- Write posts based on your **assigned roles**.











- Try to state your views and ideas **clearly and concisely** when possible and try to avoid repetitive and verbose sentences.
- Words that disrespect/hate/slander/curse other students are prohibited.

The process of writing a post

1. Check what role is assigned to you every Sunday and learn what tasks are required to perform your role.
2. Carefully read the presented topic/question/prompt every Sunday.
3. Go through all the assigned reading materials.
4. When reading the materials, highlight essential keywords and sentences by considering the questions.
5. Roughly write down what you have in mind.
6. Read your first draft and improve by adding new sentences, rephrasing words, or deleting repetitive or unnecessary parts.
7. Upload your post under your group discussion channel.

Good example of a post

Edit View Insert Format Tools Table



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Role: Supporter


Amy, thank you for sharing your thought about learning.

I agree with you that learning is created through interactions between people. Your opinion is compatible with the socio-cultural point of view. As explained on this site (<https://helpfulprofessor.com/sociocultural-theory-education/>), students and teachers interact and create knowledge together in a learning environment. From this point of view, the student is no longer a passive being who accepts knowledge but an active subject in the learning process and creates his or her own knowledge based on interaction. If so, what is the role of students and teachers in the learning process from this point of view?

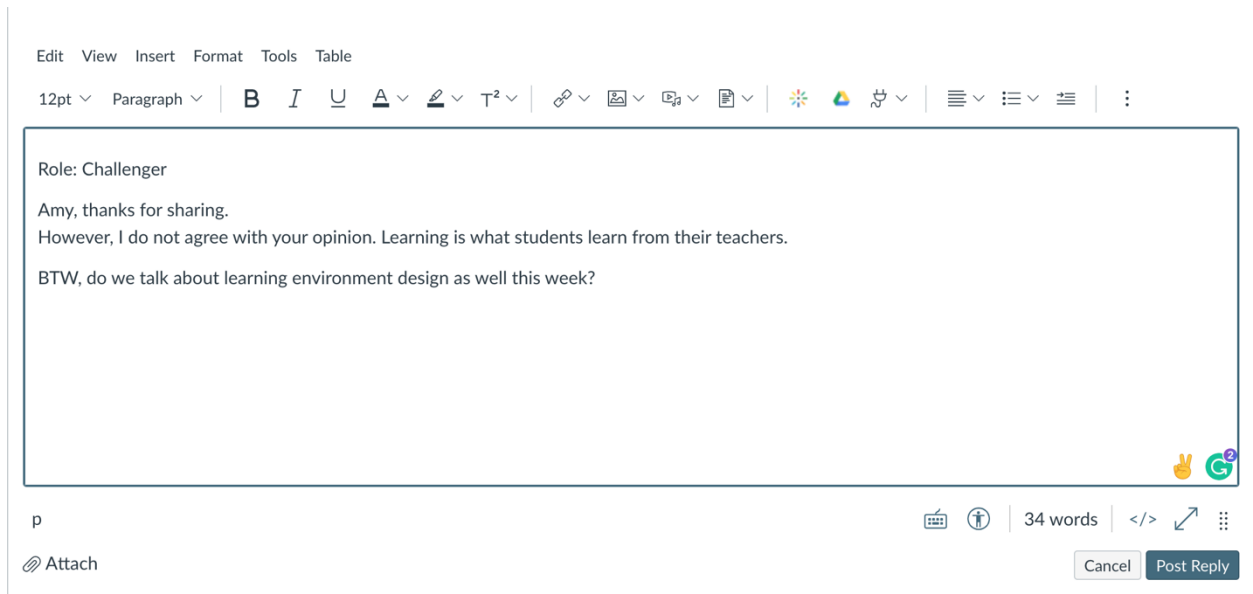
Thank you!

p   | 106 words |   

 Attach

Bad example of a post



The screenshot shows a forum post editor interface. At the top, there is a menu with options: Edit, View, Insert, Format, Tools, and Table. Below the menu is a rich text editor toolbar with various icons for text formatting (bold, italic, underline, text color, background color, text size), linking, image insertion, video insertion, document insertion, and list creation. The main text area contains the following text:

Role: Challenger

Amy, thanks for sharing.

However, I do not agree with your opinion. Learning is what students learn from their teachers.

BTW, do we talk about learning environment design as well this week?

At the bottom right of the text area, there are two small icons: a peace sign and a green 'G' with a notification bubble.

Below the text area, there is a status bar showing 'p' (paragraph), a link icon, a Facebook icon, '34 words', a code icon, a share icon, and a more options icon. On the left, there is an 'Attach' button. On the right, there are 'Cancel' and 'Post Reply' buttons.

If you have any questions or problems regarding online discussion, feel free to contact me at sunseol@iu.edu.

Curriculum Vita

Sunmi Seol

EDUCATION

Doctor of Education in Instructional Systems Technology
Indiana University-Bloomington. 2019-2023

Master of Science in Instructional Technology
San Francisco State University. 2011-2013

Master of Engineering in Electronic Engineering
Sogang University. 2001-2003

Bachelor of Engineering in Electronic Engineering
Sogang University. 1996-2001

RESEARCH INTERESTS

Online Learning, Interaction, Higher Education, Technology Use in Education, Mobile Learning, Mobile Technology, Math Education, Computer-Supported Learning, Collaborative Learning, Peer Learning, ICT Intervention, Machine Learning, Virtual Reality, Artificial Intelligence

PROFESSIONAL EXPERIENCE

Mobile App Developer, Graduate School of Education, Stanford University, Jun 2017 – Current

Graduate Teaching Assistant, Graduate School of Education, Indiana University Bloomington, Jan 2022 – Dec 2023

Mobile App Developer, Learning Content Designer, and Researcher, Enuma Inc., Jul 2013 – Sep 2017

Graduate Research Assistant, Graduate School of Education, Stanford University, Mar 2013 – Jun 2012

Mobile App Developer, Graduate School of Education, Stanford University, Mar 2013 – Jun 2012

Mobile App Developer, Seeds of Empowerment, Mar 2013 – Aug 2011

Software Engineer, CAE center at Semi-conductor, Samsung Electronics, Feb 2003 – Jun 2008

Graduate Research Assistant/Teaching Assistant, Sogang University, Feb 2001 – Dec 2002

HONORS / AWARDS

Women in Hardware - Bay Area Networking Brunch invitation recipient, Google, 2023

Women Impact Tech 2023 conference invitation recipient, WIT, 2023

Annual Banquet guest speaker, Bechtel International Center at Stanford University, 2023

Women Impact Tech 2022 conference invitation recipient, WIT, 2022

Proposal Presentation at IST Conference, 2020

Mobile Women in Tech Dinner, Netflix, 2019

Stanford FMC IWD 19 guest speaker, Stanford University, 2019

Women Impact Tech 2019 conference invitation recipient, WIT, 2019

Grow with Google Developer Scholarship to the Android Basics Nanodegree program 2018 Recipient

Grow with Google Challenge Scholarship 2018 Recipient

2015 & 2016 Grace Hopper Conference travel grant recipient, Google, 2015 & 2016

2014, 2015, 2017, 2018, 2019, and 2022 Women Techmaker Summit invitation recipient, Google

Graduate Student Distinguished Achievement Awards, SFSU, 2013

Anita Borg Scholarship US Winner, Google, 2012.

SIGITE 2012 travel grant recipient, SIGITE, 2012

Marianne Dieckmann grant winner of SEF award, Stanford University, 2011

Mobilize 100K Challenge (mobile educational app concept competition) 3rd winner, Marvell, 2011

Samsung Fellowship, Samsung Electronics, 2001 ~ 2002

PAPERS

Seol, S., Huber, J., Obermeyer, S., & Driesse, J. (2020). A Case Study in Needs Assessment: Teacher Use of Canvas for Grades K-2 Classes. In *Society for Information Technology & Teacher Education International Conference* (pp. 817-825). Association for the Advancement of Computing in Education (AACE).

Seol, S., Lee, H. K., & Park, S. (2017). A Case Study on the Effectiveness of a Mobile Math Game Promoting Students' Engagement in a Kindergarten Classroom. In *Society for Information*

Technology & Teacher Education International Conference (pp. 1809-1816). Association for the Advancement of Computing in Education (AACE).

Seol, S., & Lee, H. K. (2016). Teachers' Perceptions on the Use of a Mobile Math Learning Application in an Elementary Classroom. In *EdMedia+ Innovate Learning* (pp. 877-886). Association for the Advancement of Computing in Education (AACE).

Seol, S., Sharp, A., & Kim, P. (2012). Use of a mobile application to promote scientific discovery learning: Students' perceptions towards and practical adoption of a mobile application. In *Proceedings of the 13th annual conference on information technology education* (pp. 121-126).

Kim, P., Chiang, Y. H. V., Karimi, A., & Seol, S. (2012). Using mobile phones to scaffold student-generated questions and promote a global Student-centered Mobile Interactive Learning Environment (SMILE). In *Society for Information Technology & Teacher Education International Conference* (pp. 3462-3465). Association for the Advancement of Computing in Education (AACE).

Seol, S., Karimi, A., Kim, P., Goyal, A., Dodson, B., & Lam, M. (2011). Pocketschool interactive learning ad-hoc network. In *Proceeding of the International Conference on e-Education, Entertainment and e-Management* (pp. 70-75). IEEE.

Seol, S., Sharp, A., & Kim, P. (2011). Stanford Mobile Inquiry-based Learning Environment (SMILE): using mobile phones to promote student inquires in the elementary classroom. In *Proceedings of the International Conference on Frontiers in Education: Computer Science and Computer Engineering (FECS)* (p. 1). The Steering Committee of The World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp).

WORKSHOPS/DEMOS

"SMILE (Stanford Mobile Inquiry-based Learning Environment) Workshop for Mobile Learning and Assessment," AECT, Nov. 2011.

Short demonstration of SMILE (Stanford Mobile Inquiry-based Learning Environment), International m4Ed4Dev Symposium, Washington, DC, August 18-19, 2011.

"Enhancing Learning with Android Mobile Applications: The Development and Evaluation," E-learn by AACE, Oct. 2010.

CONFERENCE PRESENTATIONS

2020. A Case Study in Needs Assessment: Teacher Use of Canvas for Grades K-2 Classes. In Proceedings of SITE: Society for Information Technology and Teacher Education.

2020. A Case Study in Needs Assessment: Teacher Use of Canvas for Grades K-2 Classes at Batesville Community School Corporation. IST conference in Indiana University Bloomington.

2017. A Case Study on the Effectiveness of a Mobile Math Game Promoting Students' Engagement in a Kindergarten Classroom. In Proceedings of SITE: Society for Information Technology and Teacher Education.

2016. Teachers' Perceptions on the Use of a Mobile Math Learning Application in an Elementary Classroom. In Proceedings of EdMedia: World Conference on Educational Media and Technology.

2012. Use of a Mobile Application to Promote Scientific Discovery Learning: Students' Perceptions towards and Practical Adoption of a Mobile Application. In Proceedings of the 13th annual conference on Information technology education.

2011. Stanford Mobile Inquiry-based Learning Environment (SMILE): using mobile phones to promote student inquiries in the elementary classroom. In Proceedings of the 2011 International Conference on Frontiers in Education: Computer Science & Computer Engineering.

LANGUAGES

Korean (native)

English (Fluent)

Japanese (intermediate)