

Analysis of Online Discussion Forum in Constructing English Language Skills Through Collaborative Learning of Preservice Teachers in Indonesia¹

Tri Wahyuni Floriasti², Yogyakarta State University, Yogyakarta, Indonesia

Abstract

Considering the benefit of applying e-learning for teaching and learning, such as sharing ideas, seeking input, and giving feedback and clarification, one approach is an online discussion forum that provides learners with a wide opportunity to exchange and work collaboratively. In fact, some researchers have also advocated using collaborative learning activities. Considering the benefits of using online discussion forums and collaborative learning, especially the online discussion forum, this study focuses on preservice teachers using online discussion forums in General English. The aims were to analyze the knowledge construction that can occur while having a discussion and it was done by examining transcripts with the Interactive Analysis Model. In addition, this study also analyzed learners' collaborative behavior working in groups. The results revealed that most of the exchanges occurred in Phase 1: *Sharing and comparing information*, i.e., 39% for Topic 1: *Favorite places*, and 64% for Topic 2: *Traveling plan*, and the fewest exchanges were in Phase 5 (*Application of newly constructed knowledge*) that had 6% for both Topic 1 and Topic 2. To conclude, this study describes various knowledge construction and collaborative behavior phases. Further research in the online learning environment is needed to identify preservice teachers' learning needs and obstacles in cognitive and social-economic issues.

Resumen

Teniendo en cuenta los beneficios del aprendizaje electrónico, como compartir ideas, buscar aportes y brindar comentarios y aclaraciones, una opción es un foro de discusión en línea que brinda a los alumnos una amplia oportunidad para intercambiar y trabajar en colaboración. De hecho, algunos investigadores también han abogado por el uso de actividades de aprendizaje colaborativo. Considerando los beneficios de usar foros de discusión en línea y el aprendizaje colaborativo, especialmente el foro de discusión en línea, este estudio se enfoca en los futuros maestros que usan foros de discusión en línea en inglés general. Los objetivos fueron analizar la construcción de conocimiento que puede ocurrir durante una discusión y se hizo mediante el examen de transcripciones con el Modelo de Análisis Interactivo. Además, se analizó el comportamiento colaborativo de los alumnos trabajando en grupos. Los resultados revelaron que la mayoría de los intercambios ocurrieron en la Fase 1: *Compartir y comparar información*, es decir, el 39% para el Tema 1: *Lugares favoritos* y el 64% para el Tema 2: *Plan de viaje*, y la menor cantidad de intercambios se dieron en la Fase 5 (*Aplicación de conocimiento recién construido*) que tuvo un 6% tanto para el Tema 1 como para el Tema 2. Para concluir, este estudio describe varias fases de construcción del conocimiento y comportamiento colaborativo. Se necesita más investigación en el entorno de aprendizaje en línea para identificar las necesidades de aprendizaje de los futuros maestros y los obstáculos en cuestiones cognitivas y socioeconómicas.

Introduction

Collaborative work using technological tools is common nowadays. These tools pervade every aspect of life, including education. In the past decades, educators have shared activities using technology, known as e-learning, which has grown and become an essential component for all teaching activities (Chen et al., 2010). E-learning enables users to do things that may have been beyond their reach in the past, such as attending classes from different parts of the world and experiencing distance learning in real time. In addition, e-learning offers valuable chances for contacting, displaying, and exchanging information during the teaching-learning process (Zarei & Hussin, 2014). Therefore, pedagogical innovation in the technology-enhanced foreign language classroom is needed for students to acquire knowledge, learn how to use technology, and simultaneously engage with other learners. Furthermore, technology use in the foreign language classroom provides students with potential ways to do things that people were not able to do before, such as participating in online discussion forums, sharing live reports, and having more opportunities to develop their English language skills (Sadaghian et al., 2020).

In this study, preservice teachers (PTs) had an opportunity to practice their English skills, get knowledge of how to plan a trip, and work together as a group through an online discussion forum that provided them with numerous interaction and discussion opportunities. The online discussion forum (ODF) is part of an e-learning platform used to connect PTs and receive input and feedback. The online discussion forum also assists nervous learners to engage in conversation in a less stressful environment. Clear instructions and guidance from lectures, teaching sources, and other students participating in the discussion forums can help users complete some of their assignments and tasks (Perveen, 2021) and reach their learning goals. A group

¹ This is a refereed article. Received: 2 June, 2021. Accepted: 17 February, 2022. Published: 7 February, 2023.

² triwahyunifloriasti@uny.ac.id, 0000-0002-8386-9048

working in intense interaction requires all participants to take their part seriously. Based on the explanation above, combining knowledge and technology into a suitable design that encourages PTs to participate in intense interaction and collaboration is essential to promote discussion and cooperation, which happens in ODFs. Hence, learners gain the intended knowledge through intense exchange.

There is a growing interest in applying ODFs in educational practices to foster online collaborative learning. For example, the *Online Discussion Forum* is an e-learning platform that allows users to share ideas, discuss assigned topics, interact with their classmates and lecturers, and improve their understanding of the topics. ODFs allows PTs to manage how they see, learn, and share their knowledge of the topics, and interact with other participants. In addition, technology is a remarkable tool for PTs to permit them to achieve different learning experiences, increase language skills, such as reading and writing, and promote cross-culture understanding.

Review of the Literature

Several relevant pieces of research were conducted to seek answers about online learning. Jamaludin and Quek (2006) researched applying asynchronous online project-based environments at the primary level. Quek (2010) claimed there were research gaps between the primary and high school situations and managed to run a similar project at the high school level. Both studies revealed a stable structure of student-centered learning in their projects. Furthermore, their studies also revealed that synchronous online project-based learning supported the knowledge construction process. However, according to Quek (2010), critical thinking was low due to the small percentage of knowledge construction, an index based on the Interactive Analysis Model (IAM) by Gunawardena et al. (1997). Similar research reveals the construction of knowledge and interaction behavior on online discussion forums through collaborative learning at the master's degree level (Nor et al., 2010). The level of construction knowledge varied due to the interaction in the online forum. This research provides evidence that the use of the online forums, online projects, discussion, and interaction could give students essential advantages.

Considering the above discussion, some elements should be explored concerning online discussion forums using the IAM and the several phases of collaborative behavior: the level of knowledge construction PTs reach; the type of information PTs shared in each topic; the collaborative kind of behavior or attitude they share, and the interaction and collaboration in the process of constructing knowledge.

Therefore, this article focuses on the process of knowledge construction by PTs through their involvement in ODF. The IAM is utilized to analyze knowledge construction.

Online Discussion Forum

In this study, the creation of ODFs was based on three aspects: 1) the pedagogical aspect, which means it a description of what they need to know, what they want to learn, and how the knowledge will be delivered; 2) the technological aspect offers 'freedom' of learning regarding the when, where, and by which means, leaving it up to the learners' study pace and willingness to work; 3) the third aspect focuses on the learner, the students' attitudes, behavior, and collaborative interaction in the online discussion forum. When simultaneous interactions occurred, PTs could understand the messages and context. In addition, ODF facilitates that all parties interact and engage in a similar context. Thus, through an intense exchange of ideas, knowledge, and opinions in a specific context, plus engagement and cooperation, PTs could construct their own knowledge and think about some ideas critically, which was the aim of this study. Therefore, critical thinking is a vital component in the studying procedure (Vygotsky, 1978). After all, an e-learning platform is not 'just' about exchanging ideas; once all parties, educators or teachers, and students, get involved, they are connected and then occupy themselves optimally (Hussin, 2009). As a result, the interactions in ODF reveal the construction of knowledge and interaction behavior on ODF through collaborative learning.

Online discussion forums promote independent learning and knowledge construction and develop critical thinking skills by participating in interactions, such as exchanging ideas and getting involved with other people. PTs started judging and evaluating information and decided to take or reject any of it; they went through the critical thinking process (Fitria, et. al., 2020). This further triggered and improved PTs' high order thinking skills (Floriasti, 2012).

Interactive Analysis Model

The IAM is widely used to analyze knowledge construction using computer communication (Lucas et al., 2014, Quek, 2010). It examines knowledge construction, social connections, communication in the

collaborative learning environment, response types, and involvement levels. Therefore, IAM explains some gaps between each phase of the model while co-constructing knowledge among PTs.

Gunawardena et al. (1997) reviewed past studies with different interaction and analysis models. First, they reviewed one of the models, 'message maps' developed by Levin et al. (1990). Mason (1991) developed another model that evaluated online messages in collaborative learning through computer conferencing. Moreover, before Gunawardena et al. came up with their model, they explored Henri's (1992) model and Garrison's (1992) model, both of which measured critical thinking. Newman et al. (1995) proposed five stages of the Garrison model related to Henri's model. Then, Gunawardena et al. (1997) integrated a participation component into the IAM model. In this IAM, the process of knowledge construction and critical thinking happens at a specific phase. Each of the five phases of the IAM that analyzes the knowledge construction (Gunawardena et al., 1997) represents what happens inside the learners' minds when dealing with ODF interaction. The first two phases, Phase 1 (*Sharing and comparing information*) and Phase 2 (*Dissonance*), are the early phases that learners experience during the interaction. Then, as they go more intensely through the exchange inside the ODF, the knowledge construction starts in Phase 3, which shows the *co-construction of knowledge and negotiation*. Moreover, learners verify their new insights by confirming specific issues with others. Phase 4 is still *tentative construction*, and Phase 5, the *application of newly constructed knowledge*, is the last phase in which learners get the knowledge construction complete and positively apply their ideas.

However, Nor et al. (2010) stated that the IAM showed that the most considerable portion of interaction happened in Phase 1 and Phase 2. In contrast, the percentages of interaction at later levels are low. This study exposes the variety of knowledge constructions among the participants considering various internal and external obstacles and tries to describe the five phases of the IAM and what happens in each phase.

There are various indicators in each phase of the IAM. They help identify the type of interaction happening and in which phase of knowledge construction the learners are in. For example, one of the indicators in Phase 1 is *asking and answering questions to clarify details of statements*. The transcript is categorized in Phase 1 type when a learner asks a question or shares information with other participants. This kind of transcript also shows the learners' behavior while sharing their ideas collaboratively in the same discussion group.

Collaborative Behavior

Learners working in an ODF will display specific behaviors as the result of working as a team. To understand collaborative behavior, let us look at the nature of this study's Collaborative Learning (CL) position. There is no specific definition to describe CL, but some research describes characteristics that explain CL. According to Goodsell et al. (1992), CL transforms passive students into active ones due to their active engagement and the number of activities. Collaborative behavior through group work increases the participant's engagement to boost intellectual challenge and curiosity. In this CL setting, learners work together to share and get ideas from different viewpoints and defend some arguments. Learners who hold differing opinions will adopt an open-minded attitude toward differences and construct new knowledge (Srinivas, 2011).

Working collaboratively increases learners' interaction while exchanging, sharing, and evaluating ideas. In addition, the learners' behavior is described in the five aspects of CL, which go beyond merely working together (Johnson et al., 1990):

1. *Intelligent awareness of constructive dependence on group members or positive interdependence*: Learners rely on other members to achieve their goals. Each member plays their part; if they fail to fulfill it, they will not reach their goal.
2. *Reasonable exchange--Giving help and motivating others to get involved in the discussion*: The most likely action and behavior learners would display is providing feedback on others' proposals, exchanging resources, and explaining information to assist other group members, or maybe challenging the contributions of other members and seeking to engage in debate.
3. *Individual responsibility*: All students have their part to play in the group to reach the same goals.
4. *Social skills*: Learners are motivated and assisted in initiating and doing exercises to practice specific skills such as trusting others, leading the group, making decisions, delivering personal and mass exchange, and managing conflict.

5. *Team self-assessment or group-self-evaluation*: To reach the same goals, learners self-evaluate by giving and sharing comments about the group's process and achievements, what they need to do to perform better, and what needs to be changed.

Learners' collaborative behavior can be categorized into three parts: contributing, seeking input, monitoring (Johnson & Johnson, 1996). Each category has various descriptions that classify the type of behavior into a specific type. For example, responding to a request is a type of help-giving under the contributing category. Thus, a learner with that particular behavior has the help-giving behavior in CL.

Therefore, these three research questions were posited:

1. *What level of knowledge construction do PTs reach?*
2. *What type of information do PTs share in each topic on ODF?*
3. *How do PTs interact and collaborate in constructing knowledge?*

Method

Data analysis

The data consisted of written texts from an ODF used to analyze the type of written response and collaborative behavior. The data collection steps were first attending and following the ODF to understand the flow and the situation during the discussion. The second step was downloading the forum transcript to analyze the data in detail. The next step was transferring the data to the datasheet and identifying and analyzing it according to the purpose, which IAM it is: 1) applying the phase to uncover the level of knowledge; 2) utilizing the indicators of each phase of IAM to seek a specific type of utterances; 3) using the description under categories of behavior to expose the collaborative type.

After analyzing the data, the data were written in qualitative and quantitative forms. For example, to get the percentage (P) of both the coType equation here. nstruction of knowledge and collaborative behavior, the number of participants who participated in a particular topic (Y) was divided by the total number of preservice teachers (PTs) (N) and multiplied by 100%.

$$P = \frac{Y \times 100\%}{N}$$

Participants

In this study, the participants were PTs who were still undergraduate students and would become teachers. The number of PTs was 134, consisting of 93 males and 41 females. Their ages ranged from 18 to 19 years old. Most of the PTs were first-year college students. The participants were selected based on their participation in international competitions, their frequent off-campus training, and their need to access the e-learning platform. The participants shared their oral and written consents regarding their work in e-learning platform.

Protocols, composition, and forum features

The platform is a Learning Management System (LMS) called Besmart Elearning, which the university provides. This study data was taken from one of the classes inside the Besmart Elearning platform. All students could freely access the LMS; however, there were some protocols for students to enroll in the e-learning platform. Those protocols can be seen in Figure 1.

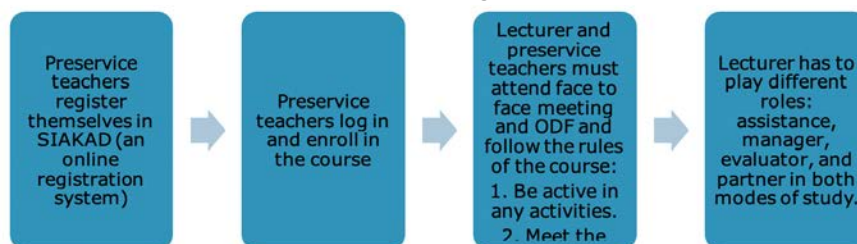


Figure 1. Protocols

Besmart Elearning is an e-learning service for PTs. It has material links, different activities, quizzes, assignments, and online discussion forums. The linked course is at <http://besmart.uny.ac.id/v2/course/view.php?id=1593&sesskey=cHxnNJA399>. The ODF was set up in a scheduled week, and the topics were related. The setting was convenient and easy for the students. The

setting was laid out to make it easy for the PTs to read it in one display and know the order and the tasks. Every meeting started by a warm greeting, sharing little clues to what the PTs would find in the panel connected to their prior knowledge. The purpose of the warming-up activities was to create closeness and warmth. Figure 2 displays a sample of the ODF.

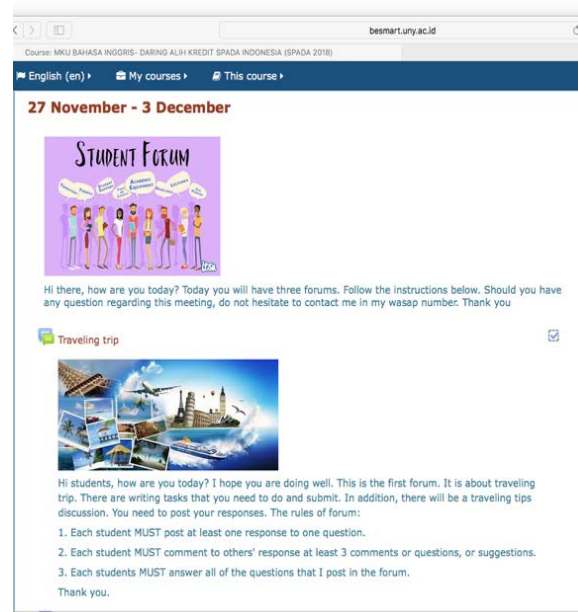


Figure 2. A Sample of scheduled online discussion forum in a week.

Within the *Besmart Elearning* platform, an ODF has specific features which are typically the same as those on other platforms, such as *Google Classroom* and *Schoology*. As an example, the ODF has the discussion area, the theme, the topic or thread host, the posting area, and the reply box. The discussions continued for only three days in this course, so PTs needed to respond within that time. Figure 3 displays one of the samples.

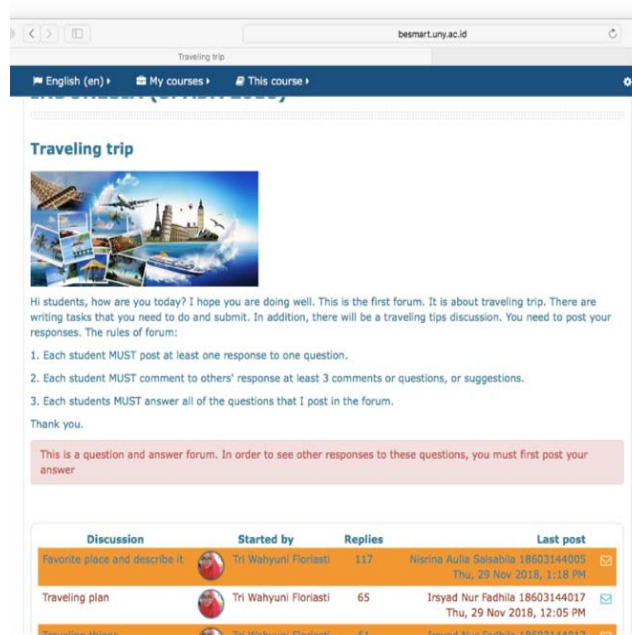


Figure 3: Online discussion forum in e-Learning

In Figure 3, in this question and answer forum specific instructions for the intended topic were included as red sentences in the box. To see other responses, one must first post an answer. As this was the first forum to introduce the following discussion, every PT was required to post their answers.

This research chose a specific course, General English, a required basic course for PTs to graduate from this University. The General English course consisted of 16 weekly meetings. The meetings had of six face-to-face sessions, 16 ODF meetings, and one evaluation session. The purpose of the face-to-face sessions was to discuss the classroom rules, what they would learn, and what topics the PTs would face in the ODF.

Finally, the ODF would end with an evaluation session to review and reflect on what they learned in the face-to-face and ODF sessions. The evaluation session was also a chance to give PTs special attention and feedback or further individual help (Fitria et al., 2020). The course details are in Table 1.

Mode of meeting	Frequency	Duration
Face-to-face session	6 times (including 1 evaluation session) in meetings 1, 5, 9 13, 16 and evaluation session in 17.	100 minutes per meeting
Online discussion forum	Three times a week	300 minutes per week, 100 minutes per meeting

Table 1. The composition of the course

Knowledge construction

To measure the construction of knowledge, the IAM was employed. This method of analysis was used to answer the first two research questions: 1. What level of knowledge construction did PTs reach, and 2. What type of information did the PTs share in each topic on ODF. First, the total number of posts in the ODF was gathered from the log file. The topics were *favorite place* and *traveling plan*. Next, the forum revealed the number of posts done by the PTs identifying their involvement in the discussion. Then, the transcripts were analyzed using the IAM, which showed various phases of interactions.

There are five phases in IAM, each with three, four, or five indicators, as shown in Table 2. The phase code was based on the phase and the indicators. For example, in the Table below, Phase 1 (Sharing and comparing information), was indicator A; for statement of observation or opinion, the code was Ph1/A. The coding was designed to help label the data from the transcription.

	Indicators	Code
Phase 1 Sharing and comparing information	A. Statement of observation or opinion	Ph1/A
	B. Statement of agreement	Ph1/B
	C. Corroborating examples	Ph1/C
	D. Asking and answering questions to clarify details of statements	Ph1/D
	E. Definition, description, or identification of a problem.	Ph1/E
Phase 2 Dissonance	A. Identifying and stating areas of disagreement	Ph2/A
	B. Answering and Asking questions to clarify the source and extent of disagreement	Ph2/B
	C. Restating the participant's position and possibly advancing arguments or considerations in its support by references to the participant's experience, literature, formal data collected, or a proposal of relevant metaphor or analogy to illustrate the point of view	Ph2/C
Phase 3 Negotiation & Co-Construction	A. Negotiation or clarification of the meaning of terms	Ph3/A
	B. Negotiation and discussion of the relative weight to be assigned to arguments	Ph3/B
	C. Identification of areas of argument/overlap among conflicting concepts	Ph3/C
	D. Negotiations and proposal of new statements embodying compromise, co-construction	Ph3/D
	E. Proposals integrating or accommodating metaphors or analogies	Ph3/E
Phase 4 Testing Tentative Constructions	A. Testing the proposed synthesis against 'received fact' as shared by the participants and/or their culture	Ph4/A
	B. Testing against the existing cognitive schema	Ph4/B
	C. Testing against personal experience	Ph4/C
	D. Testing against formal data collected	Ph4/D
	E. Testing against contradictory testimony in the literature	Ph4/E
Phase 5 Statement & Application of Newly Constructed Knowledge	A. Summarization of agreement(s)	Ph5/A
	B. Applications of new knowledge	Ph5/B
	C. Metacognitive statements by the participants illustrating their (cognitive schema) have changed as a result of an interaction.	Ph5/C

Table 2. Interaction Analysis Model (Gunawardena et al., 1997)

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Collaborative behavior

Every PT was encouraged to participate in all discussions, prompting them to reply to others' posts. They all showed a particular collaborative behavior by engaging in intense exchanges. Collaborative behavior categories were applied to analyze these exchanges to answer Research Question 3 in the collaborative learning environment (Johnson & Johnson, 1996). There were three categories consisting of one to six subcategories, all of which were used to analyze PTs' behaviors in the ODF. A description of each type of collaborative behavior was derived from the coding. For example, the category was *Contributing*, and the description was *Help Giving*; thus, the assigned code was Hg – the initial letters of each word. Table 3 shows the types of collaborative behavior, the subcategories' description, and their assigned codes.

Category	Description of behavior	Code
Contributing (Cn)	<u>Help giving</u> : responding to questions & requests from others	Hg
	<u>Feedback giving</u> : providing feedback on proposals from others	Fg
	<u>Exchanging resources & information</u> to assist other group members	Ei
	<u>Sharing existing knowledge and information</u> with others	Sk
	<u>Challenging others</u> : challenging the contributions of other members & seeking to engage in debate	Co
	<u>Explaining or elaborating</u> : supporting one's position (possibly following a challenge)	Er
Seeking Input (Si)	<u>Help-seeking</u> : seeking assistance from others,	Hs
	<u>Feedback seeking</u> : seeking feedback to a position advanced	Fs
	<u>Advocating effort</u> : urging others to contribute to the group effort	Ae
Monitoring (Mt)	<u>Monitoring group effort</u> : comments about the group's process & achievements	Me

Table 3. Categories of Collaborative Behavior

Findings and Discussions

Research Questions 1 and 2 focused on knowledge construction, while Question 3 focused on collaborative behavior when learners were working in the ODF. Question 3 also revealed both collaborative behavior and knowledge construction. The two topics, *favorite places* and *traveling plans*, were chosen based on the students' preferences.

Research Question 1

What level of knowledge construction do PTs reach?

The transcript analysis result from the ODF for Topic 1, favorite places, can be summarized as the highest percentage, 39%, falling in Phase 1 (Sharing and Comparing information). At the same time, the lowest percentage of 6% fell in Phase 5. The percentages of Phases 3 and 4 remained in the middle, as seen in Figure 4. In Phase 1, the PTs shared information with all participants showing their comprehension of Topic 1. Before attending ODF, the PTs had acquired new material about a similar topic delivered to build their knowledge of the field. Later, they worked on controlled and semi-controlled tasks and activities, for example writing an essay based on jumbled picture series. In the ODF, the students had semi-controlled activities under three different topics. Each topic had two to four sub-topics. For example, in Subtopic I, they discussed the given topic before coming to the ODF. Then they freely responded posting answers and replying to others' posts to demonstrate their understanding of the topic.

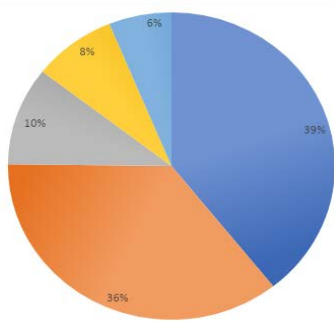


Figure 4. Analysis of percentage on Topic 1 based on the IAM model

Figure 4 displays Phase 1 at 39%, Phase 2 at 36%, Phase 3 at 10%, and the last two phases at 8% and 6%.

Next, Phase 2 dissonance reached 36% of the total percentage. In this phase, PTs discussed some ideas and concepts with others. They discussed their point of view, such as what they would do if they were in similar contexts. Examples and specific feelings were mentioned and discussed in this phase. PTs had an intense discussion and started building a bond as the conversation went on to be knowledgeable. The percentages of Phases 3 and 4 were 11% and 8%, respectively. The co-construction of knowledge happened in both stages. Even though the percentages were not significant, they started constructing their understanding at the grammatical and discourse levels, which can be seen from PTs' replies and collaborative behavior. Last, Phase 5 was only 6%. This percentage was small, most likely because few students

expressed their opinion about applying the new knowledge or concluding their understanding at the time. Thus, they did not get to Phase 5 at the end of the discussion. The explanation above shows that sharing information, answering questions, asking questions, agreeing, and restating positions were the indicators that led to the construction of knowledge.

The following data was obtained from Topic 2, the *traveling plan*. The analyzing steps were similar to those in Topic 1. It started with analyzing the contents from the transcripts of the replies posted on the given topic by PTs. Then, the data were analyzed by using the IAM model. Finally, the analysis of Topic 2 was performed to see the interaction and the construction of knowledge. The Topic 2 findings showed the highest percentage in Phase 1 was 64%. The percentages of Phases 2 and 3 were 12% and 11%, respectively. Phase 4 was 7%, and Phase 5 was at 6%.

Compared to Topic 1, Phase I in Topic 2 was much higher. In addition, the percentage of Phase 2 showed a different trend. While it decreased from 36% in Topic 1 to 12% in Topic 2, Phases 3 and 5 had the same percentage, 11% and 6%. The content analysis of PTs' discourses indicates that they were more comfortable sharing and exchanging information, examples, and personal experiences in the forum. Although there was a decrease in Phase 2, the two phases exposed a similar trend. PTs got familiar and confident in expressing their interaction in Phase 5. Thus, it can be determined that the construction of the knowledge went from stable to getting better, as shown from Phases 3 to 5.

Ph 1/A Sample: The arena is vital for me. I like the Pencak silat field.	Ph 4/A Sample: kindly share the information with If there is something happens. I will come up with a solution if such dangerous conditions as hypothermia. The things we can do in facing this are, for example: changing cloth, drink warm water, anything with warm things will help in this condition. The body heat will increase. It increases the warmth of our bodies. I am interested in hiking up, and I hope the tips work there.
Ph 2/B Sample: Because that place is breathtaking. The air is so fresh and free from pollution.	Ph 5/C Sample: Experiencing and feeling sunrise at the peak of mountains is unforgettable. I know that reaching the top of it is not an easy task. It needs a lot of effort, such as mental and physical preparation. Moreover, considering that hyperthermia makes my body weaker at this moment. It will be more complex than before.
Ph 2/C Sample: For me, it is the sound of the waves, the sand in my feet, and the sea birds. They make the beach more beautiful.	
Ph 3/C Sample: Great, so true. I find peace inside the mosque. I admit that it is the most peaceful and holiest place on Earth.	
Ph 3/D Sample: from your description of it, I understand why you find peace in the mosque. It is the place that people worship Allah to find happiness and peace.	

Table 4: Interaction and phases of the IAM for Topic 1

Research Question 2

What information do PTs share in each topic on ODF?

In Topic 1, the result showed various types of transcripts. PTs only reached some subcategories. Since every phase has several subcategories, the PTs' responses only fit in some of them. They only reached Phases 4 and 5, each having one subcategory. Identical steps were employed to analyze the transcripts of Topic 2. Tables 4 and 5 present some samples. The results showed that all five phases existed in the content. However, Phases 3, 4, and 5 had only one subcategory.

Ph 1/B Sample: I like your description, especially in the list; however, asking permission should come first so that everything will meet the procedure.	Ph 3/B Sample: How do you handle that problem if the procedure is not supporting the situation? Meanwhile, the budget part is still not compatible with the things.
Ph 1/D Sample: I will explain in more detail how I arrange the list of the procedure.	Ph 4/A Sample: I think I am going to try this. If I want to apply the A to Z procedure plus the budget part, everything should be prepared far before it, and take some time to do a little survey. Am I correct?
Ph 2/A Sample: I disagree with you in some parts, but I agree with you in the last part of the trip.	Ph 5/A Sample: Let me summarize it. I conduct price surveys through the internet and use them as well as possible. Then follow the procedure you have explained.
Ph 2/C Sample: I realize that my procedure has some weaknesses but let me explain my argumentation to support it, especially in the budget.	

Table 5. Type of interaction and the IAM phase for Topic 2

Research Question 3

How do PTs interact and collaborate in the process of constructing knowledge?

The procedure to answer Research Question 3 was to analyze the content to find the type of collaborative behavior PTs developed for Topic 1. For example, what PTs shared and how they replied to others' responses demonstrated a certain collaborative behavior in Topic 1. First, the result was analyzed and then categorized into four categories. The results showed that the contributing category of Exchanging information (Ei) was the highest at 55%, while the lowest was Giving feedback (Fg) to others at 5%.

The results also showed three behaviors under the Contributing (Cb) category. The first behavior, exchanging information, was dominant as PTs wanted to share what they knew and experienced with all participants in the forum. The purpose was to fill in the gaps in the given topic knowledge and provide more input. The second behavior was related to giving feedback, which PTs were eager to provide by answering questions and explaining things with examples to the rest of the forum's audience, especially those who needed more information. The third behavior, giving help, was the smallest in this category.

The following results reveal the behavior under the Seeking input (Si) category. The first behavior was help-seeking, which was dominant under the Seeking input (Si) category, shown by asking for more explanation about the mentioned issues in the posts that other participants shared. Finally, PTs shared essential tips and other relevant information. This category is crucial as all participants actively participated in helping and giving input. The group knew that every voice was appreciated. Therefore, seeking help from others was appropriate to gain complete comprehension and mutual understanding of the topics.

From the analysis explanation, it can be deduced that collaborative behaviors played a significant role in the five phases of interaction in the ODF. In each phase, they evidenced interaction and the learning process. Thus, at the end of the learning process, PTs had chances to learn and construct knowledge through active participation in the ODF.

Category and Code	Category and Code
<u>Contributing (Cn)</u> Cn/Fg Sample: you are correct. Keeping our warm condition will prevent us from hypothermia. Hopefully, I will be just fine there. Cn/Ei Sample: I never experienced it there. I brought a thick coat, sweater, and gloves. And try to burn something or make a fire and stay close to the fire. It will help in avoiding hypothermia. Cn/Hg Sample: I will help you, and I am more than happy to describe it for you. That picture is about how to plant rice. A farmer does it in specific ways like this picture. It spreads from up there to down here.	<u>Seeking input (Si)</u> Si/Hs Sample: I just heard it. Can anybody explain what SLG is? Is it a tool or a security process? I do not understand it.

Table 6. Collaborative Behaviors for Topic 1

The explanation of the abbreviations in the table above can be found in Table 7 below.

Category	Description of behavior	Code
Contributing (Cn)	<u>Help giving</u> : responding to questions & requests from others	Hg
	<u>Feedback giving</u> : providing feedback on proposals from others	Fg
	<u>Exchanging resources & information</u> to assist other group members	Ei
Seeking Input (Si)	<u>Help-seeking</u> : seeking assistance from others,	Hs

Table 7. Explanation of abbreviations

Next, the collaborative behaviors for Topic 2 showed that the Contributing category took the highest percentage. Exchanging information (Ei) had the highest percentage under this category at 51%. Asking the forum questions was in second place at 20%. Furthermore, seeking confirmation and responding to others' requests were at 9%, followed by confirming at just 2%. In consequence, the collaborative behaviors were categorized into five phases.

From Table 8, it can be inferred that the PTs were exposed to various collaborative behaviors such as Exchanging information (Ei), giving questions, responding, confirming, and seeking confirmation through

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online discussion. The data showed that ODF was the platform that bridges PTs in constructing their knowledge at the grammatical and discourse levels. Moreover, the percentage of co-construction was stable in Topic 2. In other words, PTs navigated the process of co-construction and the construction in these phases.

Category	Category
<p><u>Contributing (Cn)</u> Cn/Er Sample: We found the link was helpful when I did the survey. It gives extra help in preparing things.</p> <p>Sample: Can anyone help me with this situation? Why do we need to follow those sources?</p> <p>Cn/Co Sample: I will clarify my tips. In this situation, go to and check the list your first, then go to other parts. I hope this helps you.</p>	<p><u>Seeking input (Si)</u> Si/Hs Sample: Is there anyone who can explain the term he used because I cannot follow the explanation.</p>

Table 8. Collaborative Behavior for Topic 2

Discussion

How do the PTs interact in the ODF? Initially, all PTs were at the same starting point in the discussion and shared ideas quickly. The PTs realized they could establish a connection since they shared authority and acceptance in the group because they were doing similar activities. Then, they moved to a specific behavior by seeking input, meaning they were reaching for others' help, peer feedback on various issues, and other things. PTs constructed their knowledge from this category. This is relevant since learning is conceived as something a learner does, not done to the learner. Students do not passively accept knowledge from the teacher or the curriculum. Instead, students activate their existing cognitive structures or construct new ones to subsume the new input (Johnson et al., 1990). A positive attitude in any collaborative category shows that the engagement was there while they shared their ideas, opinions, and a helping hand. It also meant exchanging information to achieve a similar understanding of specific ideas as a group goal. The numbers were high for both topics, 55% and 51%, respectively. As PTs worked collaboratively and showed a positive attitude towards engagement, a positive interdependence was constructed. This valuable promotive interaction occurred when they helped each other to reach a common goal (Johnson & Johnson, 1989).

The contributions were more significant than seeking input, with various categories of collaborative behavior. Those numbers mean that PTs tried to put more effort into creating answers, such as exchanging information, seeking confirmation, and giving questions – 59% in Topic 2 and 72% in Topic 1. Meanwhile, giving feedback is only 11% and 28% in both topics. That can be related to the research conducted by Johnson and Johnson (1996) that between 1898 and 1989, over 375 experimental studies revealed that the more conceptual the task, the more problem-solving required. Thus, the type of task and the number of efforts influenced collaborative behavior. Giving feedback plays a crucial part in problem-solving, as it supports students in achieving better in the lesson (Caceres et al., 2019).

A similar trend in master's degree students (Nor et al., 2010) and undergraduate PTs reveals that the knowledge construction levels happened mainly in lower Phases 1 and 2. Meanwhile, only small percentages occurred in the higher phases. The data from Topics 1 and 2 confirmed that the example information from a personal point of view, agreement, disagreement, confirmation, and co-construction knowledge of PTs happened in the lower phases. The from both topics implies that they were engaged in intense interaction in the ODF.

Meanwhile, according to the IAM model (Gunawardena et al., 1997), interaction is the crucial process contributing to knowledge co-creation. Thus, the analysis of all transcripts began seeking activities such as asking and answering questions, clarifying some sources, negotiating some terms, synthesizing facts, and summarizing agreements. A reasonable explanation for this trend is the type of learning. The learning that PTs performed was adding other examples or concepts. Gunawardena et al. (1997) called that concept a 'pooling of knowledge,' meaning giving more to something that already is common knowledge. In Phase 1, PTs played in their comfort zone as they assumed that giving or expressing something more could not be a "smart move." Playing it safe can be connected to their sociocultural background or learning environment. There was an assumption among PTs that if they expressed themselves more, they could be called "Know

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it Alls". As Vygotsky (1962) stated, the socio and cultural influence of psychological and cognitive, behavioral development play an essential part in collaborative learning. In addition, PTs' backgrounds must be considered in these collaborative activities. In other words, considering students' different backgrounds is a significant aspect of learning (Clarida et al., 2015). Thus, the sociocultural environment influenced PTs' behavior to stay in lower phases.

The type of written response that PTs shared in ODF revealed another explanation of the most considerable percentage in lower phases. The ODF format allowed them to 'stay' in the lower stages. However, the PTs found that higher steps needed more knowledge and other skills, such as summarizing. In addition, the grammar errors and misspellings in PTs' writing led to the conclusion that they also had limited writing skills, which explained why short responses adding to others' examples and giving quick answers were predominant. Based on the analysis, long replies consisted of models and personal points of view. Some posts also contained links and pictures explaining or describing their expectations and feelings. However, in the PTs' posts short responses asking for clarification, confirmation, or help predominated.

Further analysis discovered that 86.1% of PTs had personal problems. Due to lockdown restrictions, their parents' financial conditions influenced the PTs' access to the e-learning course. The percentage of parents with a low income was 58.5%, and 44.4% of PTs were affected in accessing the course. The data were gathered to determine PTs' learning needs, wants, and problems and how the situation affected the PTs' daily learning. Therefore, designing the ODF format and its rules was vital, encouraging PTs to reach all higher phases. Designing a suitable ODF that matches their learning needs and wants is an excellent step to reach the last phase of IAM. One good design could be setting up a small ODF group that considers the PTs' different backgrounds and includes a special session to help them develop their writing skills.

Conclusions

This study's data on knowledge construction' level, type of information, type of collaborative behavior, and how they collaborated through an ODF helped respond to all four research questions. There is knowledge construction during the discussion, and collaborative behavior also supports the evidence that it happened. The findings on the two topics, *favorite places* and *traveling plans*, have provided evidence that undergraduate PTs underwent a learning process through ODF at various interaction levels. The data showed three behaviors under the contributing category: exchanging information, help-giving, and feedback-giving. Moreover, help-seeking was dominant under the input category, which was demonstrated by asking for more explanation about what had been mentioned in previous posts shared by other participants. Lastly, PTs also shared essential tips and additional relevant information. The data implied that the PTs got involved in intense positive interdependence, which meant that any of them agreed to go hand in hand to reach their common goals. In addition, various interactions help them encourage other participants to voice their minds positively, letting the lower performers feel comfortable and confident. The critical concept is that the PTs successfully worked together in collaborative learning as they took their roles seriously, revealing a particular behavior. Showing respect and acknowledging others' knowledge and abilities were vital to a successful end (Panitz, 1996). Thus, it is clear that PTs learning and working together through ODF exposed valuable collaborative behavior.

The data from the content analysis revealed that PTs' contributions through the discussion reflected their cognitive aspect, meaning that knowledge construction occurred. Moreover, what PTs had in mind was voiced in collaborative behavior, such as sharing information and encouraging others to respond by asking for information. These behaviors were an action to show their comprehension of both topics. PTs had an intense discussion and started building a bond as the conversation went knowledgeable, which happened in Phases 3, 4, and 5. Then PTs started constructing their understanding at the grammatical and discourse levels, which can be seen in their replies and collaborative behavior. The use of IAM revealed the PTs' abilities to construct knowledge at different levels in the ODF.

This study also revealed the construction knowledge outcomes in the different phases. Moreover, PTs showed diverse collaborative behavior while discussing and working in group. However, this research did not consider several factors, such as social-economic, sociocultural, internet access, and gender issues, which played a significant role in the students' learning process. Thus, further research in the online learning environment is needed, focusing on pre-service teachers' learning needs and obstacles related to cognitive and social-economic issues.

Acknowledgments

This study is a part of the SPADA INDONESIA research program under BELMAWA of the Higher Education Department. The gratitude goes to all the PTs who took part in this study.

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