



Ozudogru, M. & Akkus-Cakır, N. (2021). Computer supported asynchronous online discussions in teacher education. *International Online Journal of Education and Teaching (IOJET)*, 8(4). 2598-2617.

Received : 30.06.2021  
Revised version received : 10.08.2021  
Accepted : 17.08.2021

## COMPUTER SUPPORTED ASYNCHRONOUS ONLINE DISCUSSIONS IN TEACHER EDUCATION

(Research article)

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### Abstract

This study aimed to investigate end-of-course achievements, cognitive levels of the pre-service teachers' posts, interaction types and their perceptions about asynchronous online discussions. In this mixed method research study, 72 pre-service teachers were included adopting a convenience sampling method. Moreover, 10 volunteering pre-service teachers were selected for the interviews according to maximum variation sampling method. The data were collected through an achievement test, students' Edmodo posts and semi-structured interviews, and analyzed through an ANCOVA analysis, chi-square test and thematic analysis. The results of the study showed that although the mean scores of experiment group was higher than the control group, being either in cased-based-discussion group or control group did not affect the curriculum knowledge of pre-service teachers significantly. Experiment group tended to make more posts than the control group; however, the difference was not significant. Finally, although pre-service teachers mostly mentioned affordances of asynchronous online discussions such as engaging learners, increasing peer interaction, obtaining feedback, having more time to think before posting responses, they also stated internal and external limiting factors to post in asynchronous online discussions which were discussed in detail.

*Keywords:* Cognitive levels of online posts, interaction, online discussions, teacher education

### 1. Introduction

Online discussions are widely used to support group discussions by applying the principles of constructivism which focuses on the learning process and mutual interactions among participants while they exchange, clarify, elaborate, and/or defend their ideas (Hara, Bonk, & Angeli, 2000; Brooks & Jeong, 2006; Gilbert & Dabbagh, 2005; Hew & Cheung, 2003; Pena-Shaff & Nicholls, 2004; Zhu, 1996). Gilbert and Dabbagh (2005) highlighted the importance of meaningful online discussions as one of the main goals of constructivist learning as it facilitates knowledge construction through reflecting on the posts of others, negotiating meaning, interpreting the content to others critically, making inferences, and relating course content to prior knowledge and experiences of others. Moreover, online discussions can foster learning since learners retrieve knowledge from memory, reorganize it and reveal what they know to other participants through interacting with them (De Wever et al., 2006). With prompts that would engage students in project-based and problem-based learning, it is also possible to promote students' creativity in asynchronous online discussions (Corfman & Beck, 2019).

Literature highlights that the interaction of online learners is an indispensable and fundamental element of knowledge acquisition and cognitive development in a variety of courses and levels of education (Fung, 2004; Khlaif et al., 2017; La Pointe & Gunawardena,

2004; Pena-Shaff & Nicholls, 2004; Sing & Khine, 2006; Wang et al., 2009). Therefore, determining students' interaction in online learning is important for knowledge construction purposes since the interaction influences the quality of learning and achievement (Delaney, Kummer, & Singh, 2019; Milman, 2017; Sing & Khine, 2006). More specifically, the quality of learning outcomes depends on the nature of the interaction, which involves not only communication but also the transmission of complex cognitive dimensions such as engaging, understanding, questioning, reasoning, critical thinking, reflecting, answering, elaborating, problem resolution and depth of processing (Dahlstrom-Hakki, Alstad & Banerjee, 2020; Harrington, 1992; Henri, 1992; Lee-Baldwin, 2005; Pena-Shaff & Nicholls, 2004; Plešec Gasparič & Pečar, 2016; Szabo & Schwartz, 2011; Wang et al., 2009; Woodcock, 2009).

Learners tend to assess the quality of online learning based on their experiences and perceived interactions with the instructor and peers (De Wever et al., 2006). Since the communication among peers is conducted mostly in written form, sometimes this may result in the loss of face-to-face interaction among learners and instructors (Sher, 2009). Furthermore, despite the many benefits of online discussions, lack of time or learner preference about how much time to spend on online discussions was found to limit the interaction with others and participation in online discussions which in turn limited learning (Fung, 2004).

Another point to consider is how the interaction aspect of the online learning is integrated to the course design. For example, Harasim (2017) pointed out that when online discussions were added as a secondary aspect of a course design, students tended to perform poorly. In that sense, course characteristics and how learners perceive those characteristics are associated with learners' online interaction and engagement in an online learning environment too (Purarjomandlangrudi & Chen, 2020). Also looking merely at interaction is not enough, as there is confounding results in the literature pointing the interaction of learners with other learners and instructors, and their being active in online discussions influence the number and depth of their posts besides course achievement (Jo, Park, & Lee, 2017). For instance, in the study conducted by Redmond et al. (2014), although the education students were highly active in the online discussions, their posts were at superficial levels and did not include high levels of critical thinking. In addition, some studies examined pre-service teachers' (PsT) posts for critical thinking skills (Redmond et al., 2014) and reflective skills (Jones & Ryan, 2014) and found out that even though they were active in terms of interaction in online discussions, the level of particular higher-order thinking skills was at a superficial level. Similarly, Sing and Khine (2006) investigated the online interaction among in-service teachers and found that although a socially cohesive knowledge-building community was formed, an in-depth and sustainable online interaction was still lacking. Pala and Erdem (2015) also revealed that some of the PsT tend to read and reply to the posts of only their peers whom they thought were more knowledgeable about the topic of discussion instead of reading all posts. Even so, studies reported that participation rate of learners is very low, lack depth and quite away from coherence (Brooks & Jeong, 2006; Sun & Chai, 2020), and some of them are the repetition of previous replies (Brooks & Jeong, 2006).

Promoting interaction in online discussions in teacher education and getting the grips of what kind of outcome it could have in term of learning is not clear (Bonk, 2003). For these reasons, the interaction types among PsT, the cognitive level of their posts and course achievement require further exploration in online teacher education learning environments. All in all, it can be seen that online learning requires interaction, thinking about posts, and construction of understanding which makes it an active process. In this sense, as stressed in the literature (Cheung & Hew, 2004; Koehler, Fiock, Janakiraman, Cheng, & Wang, 2020) online discussions facilitate defining ill-structured problems and generating possible solutions; therefore, it is thought that instruction should be related to real life-life situations which in line

with constructivism so that PsT can relate theoretical knowledge with practical situations. In this sense, the current study included real life cases (Merseeth, 1996) and questions to achieve this aim through Henri's (1992) framework in two different online learning environments.

### 1.1. The Purpose of the Study and Research Questions

This study aimed to investigate the effect of asynchronous online case-based discussions in an Education Sciences course at pre-service teacher education. Also, course achievement, cognitive levels of posts of PsT' reflections, interaction types and the perceptions of PsT were investigated:

- (1) Is there a significant difference between the experimental and control groups according to achievement test scores?
- (2) What kind of interaction and engagement do online discussions afford in terms of Henri (1992)'s analytical framework?
- (3) What are the perceptions of PsT about asynchronous online discussions?

## 2. Method

This study employed a mixed method triangulation design approach and adopted a quasi-experiment design (Creswell, 2012) to test the effectiveness of case-based discussions. The data were collected through an achievement test, Edmodo posts of PsT and, interviews were deployed to answer the remaining research questions. In this triangulation design, the quantitative and qualitative data were collected and analyzed in parallel. After analyzing the data sets independently, researchers merged them by comparing or synthesizing the separate results by transforming one data type into the other. It was conducted at a state university in Turkey during a two-hour Curriculum Development course. Edmodo was used as the platform for online discussions for six weeks as it is free, and easy to use. The same instructor offered the course to both groups. The study was approved by the Middle East Technical University human subject research ethics committee.

### 2.1. Study Group

Convenience sampling method was employed (Cohen et al., 2007). There were two classes that took the course and there were 40 PsT enrolled in one of them and 31 in the other. The classes were randomly assigned to experimental group (23 female, 17 male) (case-based asynchronous online discussion group) and a control group (11 female, 20 male) (not case-based asynchronous online discussion group). However, 37 PsT from the experimental group and 28 PsT from the control group took part in the pre-test, statistical analysis were conducted on a total of 65 PsT.

The equivalency of experimental and control groups was controlled by administering the Curriculum Development Course Achievement Test (AT) at the beginning of the semester. The results of independent samples t-test was shown in Table 1.

Table 1. *The Results of the Independent Samples t-test for Determining Equivalency of Groups (n=65)*

Group	M	SD	t	Df
Control group	45.29	14.20	1.31	63
Experimental group	40.97	12.24		

p>.05

Table 1 showed that the PsTs assigned to experiment and control groups did not significantly differ from each other at the beginning of the study based on their knowledge of contents covered in the Curriculum Development Course,  $t(63) = 1.31, p = .19$ . Ten (4 female, 6 male) willing PsT were selected for the interviews according to maximum variation sampling method to represent the diversity and richness of perspectives or characteristics and to strengthen the data (Cohen et al., 2007). In this study participants were chosen from both groups with differing number of posts, various achievement levels and gender. Six of them were in control group and four of them took part in experimental group. The codes of PsT and their properties can be seen in Table 2.

Table 2. *The Codes and Properties of PsT Chosen for Interviews*

Groups	Codes of the PsT	Gender	Achievement Test Scores	Number of posts
Not case-based Discussion Groups (Control Group)	Sa	M	55	20
	Ed	F	65	29
	Si	F	78	19
	Yu	M	50	12
	Mu	M	73	26
	Hab	M	55	21
Case-based Discussion Group (Experimental Group)	Ba	M	78	36
	Sü	F	65	7
	Ha	F	75	39
	Bu	M	85	19

## 2.2. Data Collection

Data were collected through an achievement test, Edmodo posts of PsT and semi-structured interviews.

### 2.2.1. Curriculum Development Course Achievement Test (AT)

To determine PsT' achievement an AT was developed in accordance with the aims and goals of the Curriculum Development course consisting of 37 multiple-choice questions and three matching items. The AT was implemented to 371 pre-service teachers who learned the topics of the Curriculum Development Course at the previous semester. Test Analysis Program (TAP, version 14.7.4) was used to examine the item discrimination indices, item difficulty indices, and reliability coefficient of the achievement test. After conducting the analyses, mean item discrimination index was found .40 and mean difficulty index was found .54. Finally, the KR-20 value was found to be .70. AT was implemented as pre and post-test in both groups and it took 45 minutes to implement the test.

### 2.2.2. Asynchronous online discussions

Every week PsT in both groups received two 45-minute lectures in class, which included presentation of the content and some in class activities requiring PsT' actively engage. After the face to face lecture, while PsT in the experimental group were assigned to a case-based discussion with several guiding questions related to the content of the week, those in the control

group were assigned an online discussion activity with some guiding questions without a case. The instructor provided guidelines on how to conduct online discussions and advised them to share at least three posts (one post for their opinions and two posts for commenting on at least two peers' posts) per discussion and encouraged PsT to share their opinions with reasons for agreeing or disagreeing rather than simply replying I agree or I do not agree (Gilbert & Dabbagh, 2005). Both group discussions were followed by the instructor and provided with feedback and guidance during the process when necessary.

Cases used in the study were created by the researchers. In developing the cases, primarily percept and practice framework (Doyle, 1990) was adopted. Cases were designed to reflect real-life applications of the theoretical concepts covered in the class and aimed to contextualize the content. Cases were prepared as short paragraphs and had three characteristics; (1) they started with a real-life story that represented the key principles of the topic, (2) included a challenging situation that required PsT to reason critically, and (3) guiding questions that facilitated them to reflect on their own understanding. Control group discussion topics were the same as the experiment group and included some prompts to guide PsTs just not the case.

### *2.2.3. Focus-group interviews*

The interview schedule was developed by researchers and in order to establish face validity the opinions of three experts were obtained. Two focus group interviews with PsT from both groups were conducted at the end of the semester on a voluntary basis and each lasted around 30 minutes. The aim of the focus group interviews was to get a better understanding of the participants' experiences and explore the pedagogical benefits asynchronous online discussions. The interviews were recorded with the permission of PsT, transcribed verbatim and analyzed.

### **2.3. Data Analysis**

For the first research question an Analysis of Covariance (ANCOVA) analysis was conducted to compare AT scores of experimental group and control group. ANCOVA can be performed even when there is no pre-existing significant differences between the groups on the potential covariate to obtain greater statistical power due to reduction in error variance (Frigon, & Laurencelle, 1993). For the second research question, chi-square test was conducted to assess the relationship between the two group settings and the distribution across the cognitive skills and interaction categories (Creswell, 2012).

Content analysis is conducted to compare similarities and differences between the two groups' Edmodo discussion posts in terms of cognitive engagement and interaction dimensions. Henri's (1992) analytical framework was adopted to code the data. According to Henri (1992) learning is beyond knowledge acquisition, but it is related to the learning process which requires understanding, reasoning, the development of critical skills, and problem-solving. The framework included five levels as 'elementary clarification', 'in-depth clarification', 'inference', 'judgement', and 'strategies' cognitive dimensions. Elementary clarification is related to basic understanding of course content and simply describing the subject matter. In-depth clarification is similar to Bloom's comprehension level and includes understanding a problem, identifying assumptions, etc. Inference level requires induction and deduction, linking propositions, drawing conclusions, making generalizations in relation to previous statements. The judgment level is about making decisions, criticisms, evaluations, etc. Finally, strategies category of Henri's (1992) requires coordinated actions for the application of a solution, interacting with those concerned, etc.

The interaction types were evaluated as (1) 'Explicit Interaction' including direct response and direct commentary, (2) 'Implicit Interaction' including indirect response and indirect

commentary and (3) ‘Independent Statement’ dimensions. Explicit interaction is stated as a direct response or commentary to a previous message or a person. However, there is implicit interaction among online discussion participants if indirect responses or commentaries are involved which includes responses or comments to the content of other participants without mentioning the name of the contributor. Lastly, an independent statement can be explained as an isolated post which does not lead to further statements and it lacks indicators that refers to previous messages.

A calibration session was held with the two researchers to insure consistency in using the adopted analytical framework and obtain inter-rater reliability. A complete post was taken as the unit of analysis, as it served better to the aim of analyzing the level of cognitive engagement. Any disagreements were discussed to reach a consensus and to better understand the use of framework. For instance, any disagreement related to the cognitive level of posts, such as whether posts should be classified as ‘elementary clarification’, or ‘in-depth clarification’; ‘inference’, or at ‘judgement’ level were discussed in detail. Similarly, any disagreement related to the interaction types, such as whether posts should be classified as ‘direct response’ or ‘direct commentary’; ‘indirect response’ or ‘indirect commentary’. Two researchers coded one of the sessions individually to test for interrater reliability. A Krippendorff alpha of .77 and .96 were observed for the cognitive and interaction dimensions respectively, which implies sufficient level of reliability for both dimensions (Krippendorff, 2004). The rest of the data were coded by one of the researchers.

For the third research question thematic analysis as described by Braun and Clarke (2006) was used to code the interview data. A code book was created inductively after reading the transcriptions several times. Interrater reliability of the coding scheme was calculated by Krippendorff’s alpha over 20% of the data. An alpha value of .71 was observed, which suggests sufficient level of agreement among the coders. A second cycle of coding was conducted to define the broader emerging themes and any disagreements were discussed until a consensus was reached among the researchers at this stage.

In order to increase the validity and the trustworthiness of the study and represent what the participants think, feel, and do prolonged engagement at the research site, peers debriefing, data triangulation and member checks were involved (Miles et al., 2014).

### 3. Results

#### 3.1. Results Related to AT Scores

An ANCOVA analysis was conducted to compare the AT scores of both groups where the pre-test AT scores were used as a co-variate to control for individual differences among PsT in each group. Shapiro-Wilks (S-W) tests indicated that the data exhibited approximately normal distribution ( $S-W_{Control-Pre}(28)=.97, p=.56$ ;  $S-W_{Control-Post}(31)=.97, p=.46$ ;  $S-W_{Experiment-Pre}(37)=.95, p=.10$ ;  $S-W_{Experiment-Post}(40)=.97, p=.30$ ), whereas the Levene’s tests ( $F_{Pre}(1,63)=.24, p=.63$ ;  $F_{Post}(1,63)=.67, p=.43$ ) and the non-significant interaction between pre-test and group variables ( $F_{Group*Pre}(1,61)=1.16, p=.29$ ) indicated that homogeneity of variance and homogeneity of regression slopes assumptions were tenable. Therefore, the dataset was considered suitable for carrying out a parametric test such as ANCOVA. The results of the ANCOVA analysis is summarized in Table 3.

Table 3. *The Results of ANCOVA (n=65)*

Source	SS	df	MS	F	$\eta^2$
Pre-test	1151.74	1	1151.74	12.17*	.16
Group	157.00	1	157.00	1.66	.03
Error	5868.90	62	94.66		
Corrected Total	7070.86	64			

\* $p < .01$ 

According to the results of the ANCOVA test as presented in Table 3, the groups did not significantly differ from each other based on their knowledge about Curriculum Development Course  $F(1,62) = 1.66, p = .20$ . When the pre-test scores were included as a covariate, case-study group obtained higher post-test scores ( $M=69.42, SD=1.61$ ) than control group ( $M=66.24, SD=1.85$ ); however, this difference was not significant. It can be concluded that being in either not case-based-discussion group or the case based-discussion group did not affect the curriculum knowledge of PsT significantly.

### 3.2. Results Related to the Cognitive Levels of Postings and Interaction of PsT in Asynchronous Online Discussion

In Table 4, the number of postings of PsT in control and experimental groups each week along the cognitive skills dimension were presented.

Table 4. *Frequency and Percentage Distribution of Postings across Group Conditions and Sessions*

Condition	Session						Total
	1	2	3	4	5	6	
Experimental Group	171	239	135	270	143	102	1060
	16.1%	22.5%	12.7%	25.5%	13.5%	9.6%	100%
Control Group	105	179	153	208	131	58	834
	12.6%	21.5%	18.3%	24.9%	15.7%	7.0%	100%
Total							1894

In Figure 1, the number of postings of PsT under each group condition were presented.



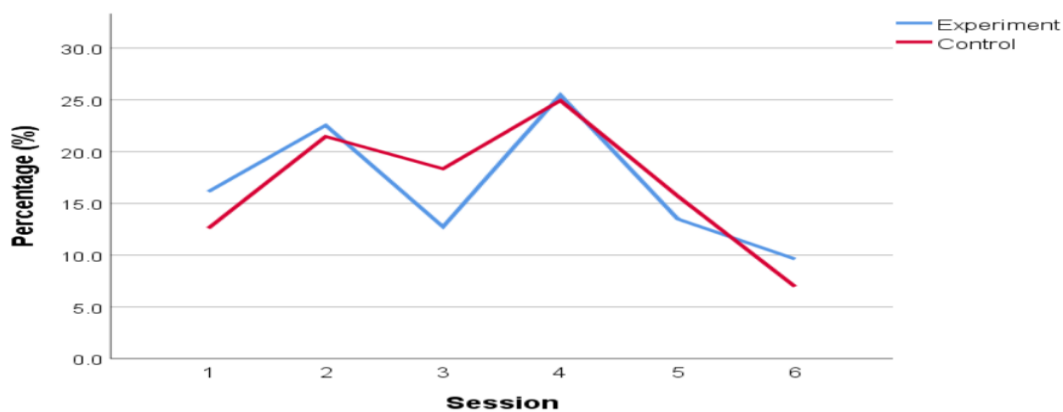


Figure 1. The percentage distribution of postings observed in the course of six weeks in the control and experimental groups.

According to Table 4 and Figure 1, the experiment and control groups had similar percentage distributions over the course of six weeks. The chi-square test for the association of group condition and session was also not significant,  $\chi^2(5) = 2.05, p > .05$ , suggesting that the groups did not differ from each other across sessions. As it can be seen in Figure 1, the largest difference was observed during first, second and fourth sessions.

### 3.2.1. Comparisons of Cognitive Levels

In Table 5, the frequency distribution and the percentages of cognitive skills dimension categories across two group types were shown.

Table 5. *The Number of Posts along Cognitive Levels and Group Condition*

Cognitive Levels	Experimental Group		Control Group	
	N	%	N	%
Elementary clarification	684	64.53	487	58.39
In-depth clarification	262	24.72	190	22.78
Inference	28	2.64	17	2.04
Judgement		0.0	1	0.0
Total Messages	1060		834	

In Figure 2, the number of postings of PsT under each group condition included in control and experimental groups along the cognitive skills dimension were presented.

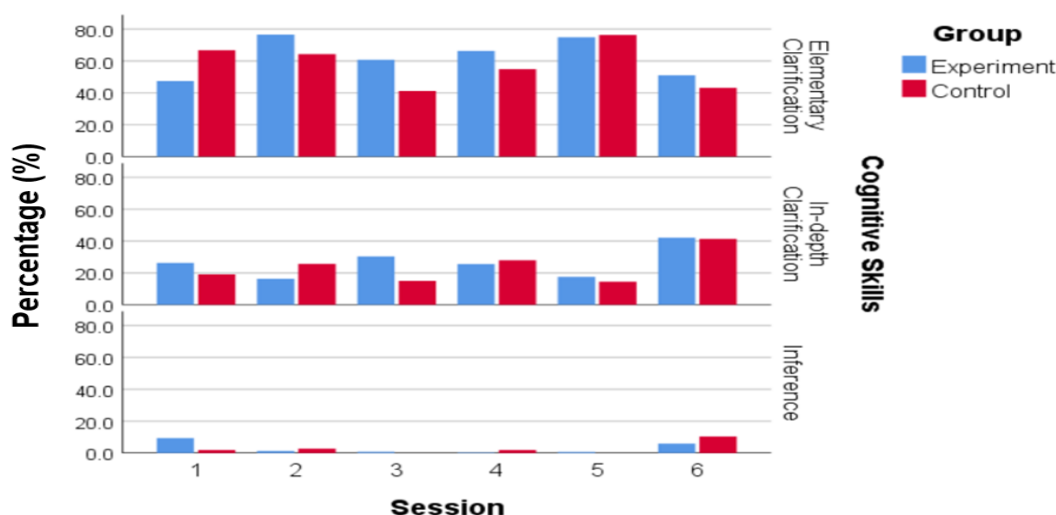


Figure 2. The frequency distribution of postings related to the cognitive levels according to groups in the course of six weeks.

As can be seen in Table 5, and Figure 2, PsT in both groups mostly reflected at ‘elementary clarification’ and ‘in-depth clarification’ levels. According to Figure 2, the percent of postings categorized as elementary clarification was noticeably higher in the case group for weeks 2, 3, 4 and 6, whereas both groups produced similar percentages of in-depth clarifications except for weeks 1 and 3. This suggests that some of the cases could be considered more engaging or stimulating as compared to the others. In both groups there were only a few postings of type inference. No clear trend was observed in terms of the number and the type of postings according to cognitive levels across the weeks.

Because judgment occurred only once it was not included in further analysis. A chi-square test was conducted to assess the relationship between the two group settings and the distribution across the cognitive skill categories, which turned out to be non-significant,  $\chi^2(2) = .01, p > .05$ . Thus, the distribution of cognitive levels of the posts observed during experiment and control group discussion types did not significantly differ from each other.

### 3.2.2. Comparison of Interaction Types

In Table 6, the frequency distribution and the percentages of interaction types of PsT across two groups were shown.

Table 6. Cross Tabulation of Posts along Interaction Types and Group Condition

Interaction	Experimental Group		Control Group	
	N	%	N	%
Direct commentary	224	21.13	332	39.81
Direct response	89	8.40	67	8.03
Independent statement	4	0.38	7	0.84
Indirect commentary	677	63.89	311	37.29
Indirect response	10	0.94	2	0.24
Total Messages	1060		834	

A similar chi-square test conducted to assess the relationship between the two group settings and the distribution of interactional content of the messages found a significant difference,  $\chi^2(4)=62.89$ ,  $p<.001$  between the two groups.

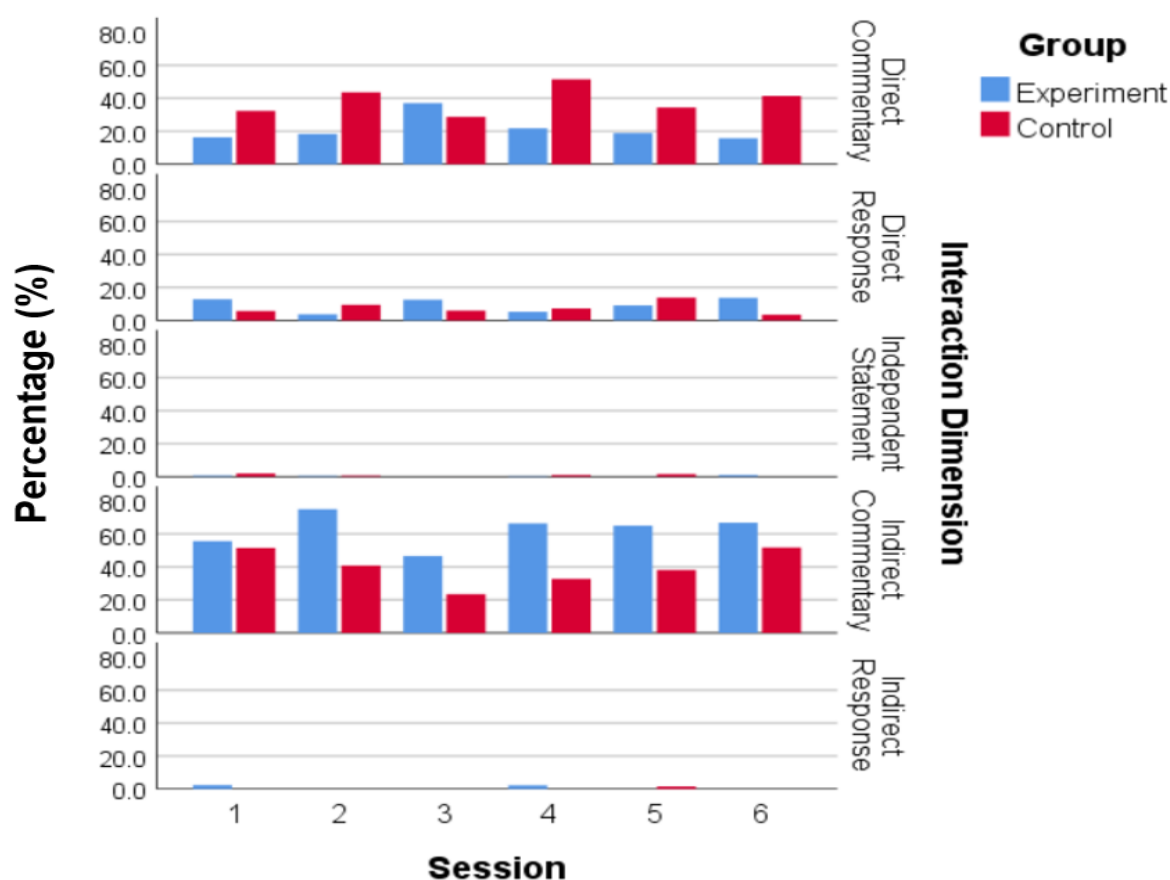


Figure 3. The percentage distribution of postings related to the interaction dimension according to groups in the course of six weeks.

As shown in Figure 3, the percentage of postings categorized as indirect commentary was noticeably higher in the experiment group, whereas the control group had higher percentage of postings of type direct commentary. Both groups have similar percentage distributions for direct responses. Indirect responses were seldom observed in both groups. This may suggest that the experiment group's discussion had a more general tone, including predominantly postings not directed to specific individuals, but rather addressing the ideas voiced in the discussion. No clear trend was observed in terms interaction of PsT in the number and the type of postings across the weeks.

### 3.3. Results Related to the Perceptions of PsT about Asynchronous Online Discussions

The purpose of the interviews was to better understand the perceptions of PsT in experiment and control group about asynchronous online discussions. The results revealed two major themes which can be seen in Table 7; (a) affordances of online discussions, (b) limiting factors.

Table 7. *The perceptions of PsT about participation in the online learning environments*

Themes	Codes
Affordances of online discussion	fosters reading the posts of others
	affords opportunity to share ideas
	leads to better retention
	facilitates participation
	facilitates interaction
	leads investigating the topic
	facilitates collaboration
	The cases facilitate better discussion
Limiting Factors	The internal limiting factors
	negative effect of compulsion
	timing of the discussion
	procrastination
	culture of discussion
	off-class participation
	to obtain higher grade
	The external limiting factors
	busy final year at university
	getting prepared for Public Personnel Selection Examination (PPSE)
the load of teaching practicum	

### 3.3.1. *Affordances of Online Discussions*

When PsT from the case-based discussion group were specifically asked about cases they reflected their satisfaction with the cases with comments such as “discussing over a case was better...[Bu]”, they stated that cases made the topic more applicable to the real life and otherwise “they could have come up with ridiculous comments” [Ba].

PsT in both groups valued interaction that online discussions facilitated the most. Even though some of them admitted reading only their close friends’ posts, or going through the posts quickly to find a post which is easy to answer so that they can write a comment and fulfill the requirement of the online discussion, in general they spoke highly of the interaction they had with their classmates due to the online discussions. Conversely, PsT described that they “would not be able to have this kind of interaction” [Ha] if it was not for the online discussions;

“...there is a discussion environment there, you see all your friends' comments, you see everybody's opinion, you notice new approaches when you see something new... there was more interaction, more communication. Otherwise, we do not know who did what...” [Bu]

PsT attributed this interactivity to several affordances of online discussions. A common barrier to interacting in a learning environment is nervousness about what others would think about you when you made a mistake. However, PsT reported that they felt safer to share their ideas online "...we hesitated to express ourselves a little or talk...but in Edmodo we write freely...[Sü]" Even if when they were not feeling confident enough to post, they reported that they had the chance to ask for assistance. In that sense, they stated that online discussions increased collaboration and in this way, they helped each other in the learning process. For example, this was reflected in one of the PsT' comment when he was telling how he asked for help from a friend because he was not able to post on his own:

"I said you need to help... She said okay, she said would help. She brought her computer, we went to the cafeteria, we were chatting and looking at the comments at the same time, we were discussing, I was asking how it would be if I say something like this... she was saying that it might be better if you wrote this... we were exchanging information..." [Sa]

According to the results of the content analysis this feeling of safety and increased collaboration also boosts participation to the online discussions;

"...so Edmodo is a little better in terms of affording everyone's participation. I mean, even someone who is quiet in class, thinks something and feels the needs to write an idea when he/she goes to the comment box..." [Ha]

According to the perspectives of PsT, active participation leads to much better retention of the content covered in online discussions. They reported for those topics they did not feel the need to go over and look at them again before the exam, as they felt it was easy for them to recall the related information. This topic was commonly reflected in such comments as,

"The Edmodo comments which I posted were in my mind ... I didn't even study those topics, for instance, I didn't even study spiral curriculum, I didn't even study the learning objectives ... I said I remember them, and I went on." [Si]

However, they also said that they often investigated the topic before they post a comment sometimes from the available resources they have such books they have and sometimes online:

"I searched on the internet before to see what kind of questions I can ask, to see how I can corner my friends with questions and then how I can ask questions or to see how I can reply to the comments." [Mu]

Such comments seemed to reflect that online discussions encouraged PsT to explore the topics and engaged them in the learning process.

### 3.3.2. Limiting Factors in Online Discussions

Despite the affordances, there were both internal and external factors influencing the potential of online discussions negatively. The internal factors refers to conditions either related to the participants or the design of the study that undermine the effectiveness of the online discussions. Among these, the most striking was about the negative consequences associated with doing compulsory school work. Most of the PsT stated that they contributed to the online discussion 'just for the sake of participation' as it was compulsory part of the course evaluation. They believed that rigid rules about the number, type (opinion/response) and timing of the post turned it into a dull, compulsory activity and their reaction was mostly like "let's just fulfill the obligation" [Yu]. Therefore they stated that the discussions included only a couple of new and interesting ideas, and the rest of the posts were quite similar. For this reason they commented that: "We might have got a better result if we had posted our ideas and comments on Edmodo to learn not just for the aim of graded by the instructor" [Sa]. Such

comments seemed to reflect a lack of motivation for meaningful participation to the process. Being unable to motivate themselves, PsT mentioned that they also frequently procrastinated participating to the discussion: “I postponed it, postponed it, postponed it, I thought that I should make comments on the last day ...” [Si]. It is inevitable for their “last night last hours” [Yu] posts to be only at a surface level, as one of them put it they “were not able to make such high level comments, there was not a deep discussion” [Hab].

Barriers to effective online discussion included some external limiting factors as well. External factors refer to the conditions that neither the PsT nor the researchers have direct control over the design of the study but effects the results immensely. The most commonly mentioned two were actually related to the fact that the participant PsT were seniors at the university. PsT mentioned the busy final year at the university limited their time and effort they spent in online discussions: “We were like this generally, because we had been very busy” [Hab, Mu, Si, Sü]. They said the reason for their low quality posts was mainly due to “the intensive work load of final year” [Bu, Hab, Mu, Si, Yu].

There was a lot of work to be done both at the university and outside of it. They stated that they were studying for the PPSE to be appointed as a teacher at the same time and therefore attending private preparatory schools after their classes at the university until late hours at night. Hence, online discussions had been daunting: “...but this year we have to study for PPSE exam and it causes quite a stress on all of us, we are attending the special course after classes, we continue school practice... there are so many burdens on us... posting on Edmodo seemed like an extra burden to us...[Hab, Mu, Si, Yu].”

As the quotation suggests they were busy and stressed because they were at their final year and getting prepared to take PPSE to be able to appointed as a teacher. Even though, they reported positive ideas about the online discussion in general, they blamed the barriers and most of them reported that they had other priorities and did not focus on online discussions.

#### **4. Discussion and Conclusions**

This study sought to examine the effect of asynchronous online case-based discussions in an Education Sciences course at pre-service teacher education. To this end, PsT’ academic achievement, discussion posts and focus group interviews were analyzed. First, the analysis did not reveal a significant difference between experiment and control groups in terms of course achievement. There are studies both supporting the idea that participating online discussions improve learning and students’ grades, (Weaver, 2005), and reporting no significant differences between the low, moderate and high participating groups according to their exam result (Picciano, 2002). In this study, both groups’ participation was similar, therefore it could be said that PsT in both groups benefitted from peer feedback and instructor support as stated by Sher (2009). Also, during the focus group interviews, as PsT in both groups stated many affordances of online discussions (Brooks & Jeong, 2006; Gilbert & Dabbagh, 2005; Hew & Cheung, 2003; Lee-Baldwin, 2005) which might have contributed to the achievement of both groups. According to PsT’ in both groups, online discussion was successful in engaging even the quiet students, as it was also the case in Cheung and Hew (2004)’s study. Also, peer interaction might have enabled PsT to explore new perspectives in terms of pedagogical approaches (Park & Bodzin, 2000) and enabled learning from others (Weaver, 2005). This might have helped them to understand the course topic better and improved themselves (Baran & Keles, 2011). Moreover, PsT mentioned that asynchronous online environment offered them more time to think about their posts and responses compared to in class activities. In other words, pre-mentioned affordances of online discussions, and interactions among PsT and course instructor might have significantly contributed to the learning of PsT in both online learning environments.

Another reason for the insignificant difference between the achievement test scores of experimental and control groups might be attributed to the evaluation type, which was a multiple-choice type exam for this course. Given the opportunity PsT might reveal their learning levels through comments to questions or cases which are similar to the weekly discussions instead of answering multiple-choice type questions, thus obtain better results as suggested by Picciano (2002). As proposed by Vo et al. (2017) it may not be plausible to conclude the effect of online learning environment on PsT' achievement by only evaluating them according to test scores without considering both the input and process variables of learners. For this reason, future studies might evaluate the achievement of learners by including their effectiveness in online discussions via assigning an appropriate percentage to their total grade. Also, as PsT claimed during interviews that online discussion led to better retention; however, the prior knowledge, willingness to learn, being accustomed to learning with technology, priorities, and workload might have affected their learning level, which should be investigated through future research.

In terms of number of the posts, case-based discussion group posted more than not case-based discussion group but the difference is not significant. Literature points out case-based can offer methods there are multiple, mutualistic interactions between the student, material and the instructor (Merseeth, 1996). In the interview analysis PsT reported that case-based discussions were better as they offered a real-life like situation to reflect on and found them useful in terms of making the discussion more meaningful and relatable (Ryan & Scott, 2008). It can be inferred that the use of cases as the focus of online discussions in teacher education enabled PsT to evaluate the circumstances critically and promote discussions through interaction among participants. This supports the claim made by Harrington (1992) that case-based method aims more than enabling PsT find the right answers, it promotes alternative thinking through complex educational cases. However, since this study included senior PsT who were studying for the PPSE, therefore attending to the courses of special institutes until the late hours at night and taking school practice courses besides their responsibilities stemming from the courses they took during the semester. Hence, both groups reported that they lacked the necessary time for constructing cognitively higher-level posts which was similar to Fung's (2000, 2007) research reporting time constraint as a major barrier for effective online discussions.

Along the cognitive dimension, despite the slightly higher percentage of elementary clarification posts in the experiment group (%64.5) as compared to the control group (%58.4), the two groups did not significantly differ from each other based on the overall distribution of the cognitive categories. Our analysis showed that both groups' posts were coded mainly in the first two elementary clarification and in-depth clarification levels according to Henri (1992)'s framework which is in line with Wang et al. (2009)'s study showing that writing reflections and knowledge construction and in class discussions of students in their study were at lower levels. Similarly, Wishart and Guy (2009) also reported that justification and clarification posts were rare and tended to decrease over time.

PsT in the current study might have posted to show the instructor what they knew or to earn participation points rather than to engage in deep discourse with other participants and explore different perspectives which is in line with the literature (Bento et al., 2005; Cheung & Hew, 2004; Hara et al., 2000; Koehler et al., (2020). Moreover, PsT might have tried to increase the number of their posts by copying and pasting from others, dividing their ideas into many posts, or they might have read the posts of hardworking peers and try to understand the basics of topics without spending a lot of and effort to engage deeply with the subject and this could be the reason for low level and quality posts (Gerbic, 2006; Pala & Erdem, 2015; Yukselturk, 2010). Therefore, they frequently posted without coming up with new ideas and 'sound along

the same lines' and procrastinated posting until to the last day (Hew & Cheung, 2003). This may create the 'feeling of social disconnection' for some of them (Branon & Essex, 2001) and generally lead to low participation and low-level performance (Michinov et al., 2011).

In terms of interaction, a significant difference was observed between the experiment and control groups. The results suggested that the difference is due to higher percentage of direct commentary messages in the control group (%39.8) as compared to the experiment group (%21.1), and the higher percentage of indirect commentary in the experiment group (%63.4) as opposed to the control group (%37.3). Students in the control group addressed their peers through direct commentaries more, but received almost the same percent of direct responses from others. This suggests that the case-based group participants did not tend to follow up on direct commentaries as much as the control group members. On the other hand, the higher percentage of indirect commentaries in the experiment group indicates that they engaged in a discussion directed towards the case, with less frequent references to specific peers. This could be due to the more hypothetical context provided by the cases where the postings referred to the imagined case and characters in an impersonal manner, rather than postings directed towards specific participants. PsT might have inclined to voice their ideas about the cases rather than taking up and discussing each other's and they did not participate at the expected level in general (Hew & Cheung, 2003).

Also, the findings of the current study matched with those of Zhu's (1996) that postings of PsT primarily included self-reflection rather than involving an interaction process during the construction of meaning. Similarly, the results of many studies revealed the lack of responses or elicited only one response (Fung, 2004; Pena-Shaff and Nicholls, 2004). In the current study, it can be inferred that PsT in both groups mostly preferred interaction in a monologue type and posted by building upon the ideas of others.

### **5. Limitations and Suggestions for Future Studies**

This study has some potential limitations that should be acknowledged. The study was conducted with a small sample size obtained via convenience sampling, which limits the generalizations that can be drawn over the broader population. For this reason, future studies may include a larger group included via random sampling for the generalizability purposes.

In the current study, a subset of Henri's analytical framework was applied which were most related to our research questions. However, the results can be considered suggestive in terms of the effectiveness of case-based discussions for facilitating online discussions. Future studies may use a different frameworks such as La Pointe and Gunawardena (2004), Hew and Cheung (2003), Palmer et al. (2008), etc. and analyze learner participation in online discussions through both quantitatively and qualitatively in line with the course objectives, content, context, and their expectations through investigating number of messages, types of the message ideas (administrative, technical, social), interaction among the participants, co-construction of knowledge among the participants, the length of posts besides the number of posts read by participants, contribution of posts to cognitive, social, and teaching presence, participants' exhibition of knowledge, comprehension, application and analysis, etc. during online discussions.

Finally, as for the implications for practice, online discussions, especially case-based discussion should be used in teacher education as they enabled more interaction. When designing for instruction, PsT's workload should be considered and their participation to the discussions should be supported and facilitated.



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