A CASE STUDY FOR TEACHING PRESENCE OF COMMUNITY OF INQUIRY IN AN ASYNCHRONOUS LEARNING ENVIRONMENT FOR PRESERVICE MATHEMATICS TEACHERS

by

Begüm Ihlamur Türkoğlu

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ABSTRACT

A CASE STUDY FOR TEACHING PRESENCE OF COMMUNITY OF INQUIRY IN AN ASYNCHRONOUS LEARNING ENVIRONMENT FOR PRESERVICE MATHEMATICS TEACHERS

Online and blended learning-teaching practices and studies are increasing with technological developments. In these environments, building learning communities are important for effective learning experiences. Community of Inquiry (CoI) framework developed by Garrison, Anderson, and Archer (2000) explains meaningful online or blended learning experiences within the interaction of social, cognitive, and teaching presence. The purpose of this study is to explore the experiences of the pre-service mathematics teachers in the asynchronous components of a blended teacher education course on the teaching presence element of CoI. It is also aimed to understand teaching presence experiences of the teacher educator in this asynchronous environment to explore students' experiences. An undergraduate blended course was selected as the focus of this case study. The data was collected through CoI survey and student interviews to explore teaching presence experiences of students. In addition, classroom observation notes, online discussions and postings, and interviews with the instructor were used as secondary data sources. Overall, the findings from CoI survey indicated that all presences of CoI yielded high perceptions in the course. The interview transcripts and secondary data sources show that teaching presence developed in the course and the experiences were parallel with the existing categories and indicators of CoI. On the other hand, the implications of teaching presence were unique to course activities and tools. There is a close interaction with the tools and teaching presence. Finally, the study found that there is a relationship between teaching presence and other presences.

ÖZET

MATEMATİK ÖĞRETMEN ADAYLARINA YÖNELİK BİR ASENKRON ÖĞRENME ORTAMINDA ARAŞTIRMA TOPLULUĞUNUN ÖĞRETİMSEL BULUNUŞLUK BİLEŞENE YÖNELİK BİR VAKA İNCELEMESİ

Çevrimiçi ve harmanlanmış öğrenme uygulamaları ve çalışmaları gelişen teknoloji ile artmaktadır. Bu ortamlarda, etkili öğrenme için öğrenme toplulukları oluşumuna vurgulanmaktadır. Garrison, Anderson ve Archer (2000) tarafından geliştirilen Sorgulayıcı Öğrenme Toplulukları Kuramı çevrimiçi ve harmanlanmış ortamlarda anlamlı öğrenme deneyimini sosyal, bilişsel ve öğretimsel bulunuşluk bileşenlerinin etkileşimiyle açıklar. Bu çalışmanın amacı, matematik öğretmen adaylarının harmanlanmış bir öğretmen eğitimi dersinin eş zamansız bileşenlerinde Sorgulama Topluluğu yapısındaki öğretimsel bulunuşluk deneyimlerini keşfetmektir. Aday deneyimlerini keşfedebilmek için öğretim elemanının öğretimsel bulunuşluk deneyimlerini anlamak da amaçlanmıştır. Bu vaka çalışmasının odak noktası olarak harmanlanmış bir lisans dersi seçilmiştir. Veriler, öğrencilerin öğretimsel bulunuşluk deneyimlerini keşfetmek için Sorgulama Topluğu anketi ve öğrenci görüşmeleri yoluyla toplanmıştır. Sınıf gözlem notları, çevrimiçi paylaşımlar, öğretim elemanı ile yapılan görüşmeler ikincil veri kaynakları olarak kullanılmıştır. Genel olarak, anket bulguları, Sorgulama Topluluğu kuramının tüm bileşenlerinin ders içinde yüksek algılandığını göstermiştir. Görüşmeler ve ikincil veri kaynakları, derste deneyimlenen öğretimsel bulunuşluğun mevcut Sorgulama Topluluğu kuramı kategorileri ve göstergeleriyle uyumlu olduğunu göstermektedir. Öğretimsel bulunuşluk uygulamalarının dersin etkinliklerine ve araçlarına özgü olduğu bulunmuştur. Araçlar ve öğretimsel bulunuşluk arasında yakın bir etkileşim görülmüştür. Çalışmada öğretimsel ve diğer bulunuşluklar arasında ilişki olduğu ortaya çıkmıştır.

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LIST OF ACRONYMS/ABBREVIATIONS

CoI	Community of Inquiry
LMS	Learning management system
PI	Practical Inquiry

1. INTRODUCTION

The existence of online and blended learning environments is increasing in line with technological developments and changing needs of society. In addition, after the Covid-19 pandemic, which affected the whole world in 2020, there was a rapid transition from face-to-face education to distance education models. As a result, the spread of online education activities accelerated. Thus, it has become essential for researchers and practitioners to make teaching and learning effective in online education environments. Recently, there has been increased interest in creating learning communities to increase the effectiveness of online and blended learning environments. In this context, the Community of Inquiry Framework (CoI) developed by Garrison, Anderson, and Archer (2000) has attracted attention and has been widely used by researchers and practitioners (Akyol, 2009; Aksoy et al., 2022). The CoI framework constitutes a structured model for the formation of a community of inquiry for online or blended learning processes with cognitive, social, and teaching presence constructs and their interactions. The purpose of this qualitative research is to explore the teaching presence experiences of students in the asynchronous components of a blended teacher education course based on students and the instructor's experiences. The study used the case study design and multiple data sources to investigate research questions. The study was conducted at the asynchronous component of a blended undergraduate course for pre-service mathematics teachers at a public university in Istanbul.

2. LITERATURE REVIEW

2.1. Distance Education

Distance Education activities and experiences date back to the 1800s. The origin of distance education is known with an announcement in a Swedish newspaper that gives the opportunity to study "Composition through the medium of the post" in 1833 (Simonson et al., 2019). In 1840, Isaac Pitman experienced shorthand instruction through correspondence in England and then there were several attempts at correspondence studies (Simonson et al., 2019). In the 19th century distance education activities started to increase via correspondence studies. In these years, one of the main reasons for the rise of distance education was to provide an equal chance to education for all citizens of the society (Saykılı, 2018). Since the 19th century, distinct definitions, concepts, pedagogies, approaches, designs, practices, and experiences have emerged. Technological developments of the age, the needs, and the pedagogies have influenced how distance education is viewed and experienced. The definition of distance education also changed with the developments in technologies and circumstances of the time. In the early years, Keegan (1980) defined six components of distance education:

- Teachers and Students separate from each other
- Affect educational organizations
- Using technical media
- Provide two-way communication
- Possibility of occasional meetings
- Participation in the industrialized form of education.

Keegan's definition tends to compare distance education with face-to-face education. Some components of the definition are not clear such as teacher and student separation. However, it is important that Keegan put emphasis on communication (Saykılı, 2018). Holmberg (1989) defined distance education and the main focus was

the concept of the student, educational system, and communication: "Distance education is a concept including learning and teaching activities with cognitive, affective, and psychomotor domains. It provides remote communication. Distance education is a planned and guided concept." Holberges' definition includes cognitive, affective, and psychomotor domains, unlike Keegan's definition. However, both definitions failed to mention different forms of distance education and their properties. Icten (2006) defined distance education as a method alternative to traditional education, and distance education activities are well-designed activities with different forms. Distance instructions are separated as asynchronous and synchronous. If the teacher and students are different in time and location, then the type of distance education is asynchronous (Manzanares and Barbour, 2010). Students work themselves with instructional materials under the guidance of a teacher in asynchronous online learning (Kozma, 2003). If the teacher and students communicate at the same time from different locations, then the type of distance education is synchronous (Arslan, 2019).

In 1999, Philipps and Merisotis explained blended learning as the third generation of distance education after the first generation of correspondence studies and the second generation of a single technology. Blended learning is defined as a combination of learning delivery methods and types such as face-to-face instruction with asynchronous or synchronous instructions (So and Brush, 2008). The blended course model is an important innovative approach to embrace the advantages of both face-to-face and online learning and to overcome the limitations of both approaches (Keengwe and Kang, 2013). Moreover, blended learning provides an opportunity to integrate innovation and the benefits of technology in online learning with the interaction and participation of the benefits of face-to-face learning (Bokolo et al., 2020). The concept of distance education evolved with the technological developments and changes of generations (Anderson and Simpson, 2012). These developments enabled researchers to conduct theoretical foundations and research about distance education. Bozkurt (2015) investigated that learning theories related to communication, collaboration, and cooperation are important frameworks in distance education research. They concluded that there is no single theory of distance education experiences because of the interdisci-

plinary nature of distance education and technological innovations (Bozkurt, 2015). Researchers should consider both technology and pedagogy of learning and teaching to be able to construct effective distance education experiences (Saykılı, 2018).

2.2. Distance Education After the Covid-19 Pandemic

Now, distance education has become a mainstream form of education with its increasing popularity and use in the 21st century. In 2020, Covid-19 started to spread through the countries, and the world health organization introduced it as a pandemic (WHO, 2020). The new pandemic affected many areas. Governments have had to take measures and one of these measures was school closures to prevent the spread of the virus (Bourouiba, 2020). Education was one of the most affected areas during the pandemic (Beltekin and Kuyulu, 2020). According to UNESCO (2020), 92 percent of students worldwide felt the impact of the pandemic on their educational lives in a short time. Thus, many countries had to make an unexpected transition to distance education to minimize the effect of Covid-19 (Hebebci et al., 2020). Teaching and learning adapted to distance to maintain educational activities because distance education was the most useful way to support educational activities during Covid-19 (Moreno and Gortazar, 2020; Ozer, 2020). Teachers had little time to plan their instructions and to prepare themselves and their students for change. Also, they needed to deal with unfamiliar technologies and tools to adapt their teaching to distance education (Kimmel et al., 2020). Thus, teachers and students faced the term distance education unexpectedly with the spread of the pandemic. In the Covid-19 era, the use of the distance education term was different because distance education should be a well-planned and designed activity (Marshall et al., 2020). This transition was not an ordinary change from face-to-face education to online education. Therefore, it was appropriate to use the term emergency remote teaching (ERT) for practices conducted during the pandemic (Marshall et al., 2020). Hodges (2020) defined emergency remote teaching as "In contrast to experiences that are planned from the beginning and designed to be online, emergency remote teaching (ERT) is a temporary shift of instructional delivery to an alternate delivery model due to crisis circumstances" (Hodges, 2020, p14).

Researchers give importance that students and teachers should understand emergency remote teaching and distance education is different (Hodges et al., 2020). Koçoğlu and Tekdal (2020) analyzed the distance education activities in Turkey throughout Covid-19. The main focus of this research was teachers' views on distance education activities. There were 12 teachers who work in a state school in Turkey. Researchers conclude that teachers had insufficient training and resources in distance education because of the unexpected transformation during the pandemic in Turkey. In another example, Marshall et al. (2020) determined the experiences of teachers in remote teaching during the Covid-19 pandemic. The main focus of this study was teachers' challenges and strategies they experienced in remote teaching. There were 328 PreK-12 teachers. Researchers used the term emergency remote teaching to distinguish immediately occurred practices from regular and planned online instructions. They hypothesized that teachers' translation to planned online instruction caused difficulties, as shown in the previous research, so this unexpected change had challenges for teachers. They found that most teachers had no training and no experience before emergency teaching. Teachers indicated their most challenging moments were related to lesson planning, assessment strategies, and motivating the students and parents. Also, limited technological sources increased the level of difficulties. Teachers noted that they had difficulties outside of the school because of the pandemic and these difficulties affect teachers' challenges in emergency remote teaching. Researchers concluded that this study's findings show a need to prepare and plan education for emergencies. Also, universities worldwide shifted more and more to online education during the pandemic (Ali, 2020). İnce et al. (2020) conducted a study during the pandemic period at a state university in Turkey. In the 2019-2020 academic spring semester of the university, distance education activities were asynchronous lecture notes and synchronous live courses. They used a survey method to determine the views of students on distance education during the pandemic process. There were 1011 students who participated in the study. The results show that participants' technological opportunities affect their views on distance education. There are also studies that examined instructors' experiences. Marek et al. (2021) conducted a worldwide survey to explore the experiences of higher education instructors who converted educational activities to distance learning

during Covid-19. They found that most of the participants experienced higher workloads and stress than face-to-face experiences. In addition to that, they found that less than half of the participants used their school's LMS, instead, they used other technologic tools. Participants explained that they need to improve themselves in terms of adaptability and good planning. The researchers recommend that there is a need for training on better online instructional design as a part of professional development.

Therefore, it is crucial to design quality online learning environments with careful instructional design and planning to be able to go beyond emergency remote teaching (Hodges et al., 2020). Garrison (2003) also indicated that the online educational experience is not simply providing access to more information, discussion, or posting, these learning environments have their own challenges and needs. In addition to design and planning, student engagement is crucial in the online learning environment (Duffy and Kirkley, 2004). Researchers emphasize creating effective learning communities to provide student engagement (e.g., Palloff and Pratt, 2005; Barab et al., 2004; Wenger, 1998). The Community of Inquiry framework (CoI) assumes that effective online education requires the development of the community in the online environment (Swan, 2009).

2.3. Community of Inquiry Framework (CoI)

An educational community of inquiry is defined as a group of learners who collaboratively engage in purposeful critical discourse and reflection to build personal understanding (Garrison et al., 2000). The CoI framework which was developed by Garrison, Anderson, and Archer in 2000 indicates a process to create a meaningful learning experience through the development of three interdependent elements which are social, cognitive, and teaching presence (Garrison et al., 2000). Then, many studies have used the CoI framework as a research tool and a theoretical lens for practice. In the original article, the CoI framework was first introduced as a tool for evaluating asynchronous online classes as reflected in the title "Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education" (Garrison et al., 1999).

Then, it has been also used for studying synchronous, blended, and other online delivery methods. The collaborative constructivist view of teaching and learning shaped the CoI framework (Garrison and Anderson, 2003). The framework grounded in John Dewey's views on individual development was dependent upon community (Swan et al., 2009). The collaborative constructivist view reflects the inseparable relationship between the social environment and individual meaning-making (Garrison and Anderson, 2003). Also, the literature particularly suggested that within online environments, the interaction between students is important for a successful learning experience (Akyol and Garrison, 2008; Arbaugh, 2008; Richardson et al., 2017). From this perspective, the CoI framework is determined as the integration of personal reflection in addition to discourse to support meaningful and deep learning experiences (Garrison and Anderson, 2003). The framework explained that the meaningful online educational experience occurs in a community at the intersection of three core elements; (i) social presence (ii) teaching presence, and (iii) cognitive presence (Swan, 2009; Garrison, 2000). The CoI framework is shown in Figure 2.1.

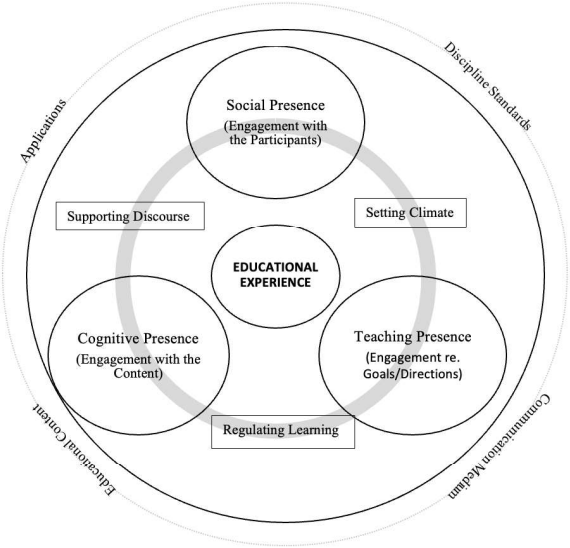

Figure 2.1. The Community of Inquiry framework.

Garrison et al. (2001) defined cognitive presence as "the extent to which the participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication." Cognitive presence is a priority for a meaningful and deep learning experience (Garrison, 2003). The second core element of the CoI framework is the development of teaching presence, which includes designing and managing the learning process, providing expertise, and facilitating. The last core element is social presence, which is explained as students' capability to reflect on themselves within the community. All presences have multi-dimensional elements. Social, teaching, and cognitive presences are operationally defined in terms of their foundations and indicators.

2.3.1. Teaching Presence

In both online and face-to-face environments, the interaction with the teacher is critical (Donaldson and Knupfer, 2002). Therefore, teaching presence is an important issue for successful online learning environments. In the CoI framework, teaching presence is defined as "the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" (Anderson et al., 2001). Teaching presence acts as the moderator of the community, plans, designs, and manages the course to be able to realize meaningful learning outcomes (Garrison et al., 2001). The teaching presence begins before the course with designing and planning components and continues during the course with facilitating, managing, and directing. There are three categories of teaching presence which are instructional design and organization, facilitating discourse, and direct instruction (Garrison and Arbaugh, 2007). The first category consists of such as introducing syllabus, uploading documents, etc. Facilitation includes reviewing, asking questions, making observations, and intervening as necessary. There must be a balance between too little and too much intervention. Direct instruction includes introducing subject matter knowledge. Teachers review misconceptions, share resources, make connections between ideas, and scaffold learning. Facilitation and direct instruction categories require pedagogical expertise and especially direct instruction requires

content expertise (Kraut, 2021). In Table 2.1, the teaching presence categories and indicators for each category are shown. These indicators were described by Anderson et al. in 2001 to explain teaching presence categories. They described the indicators to be able to measure the extent of categories of teaching presence of an online learning experience (Anderson et al., 2001). After Anderson (2001) explained the characteristics of teaching presence Arbaugh and Hwang (2006) also confirmed these characteristics.

Table 2.1. Teaching presence indicators.

Categories	**Indicators**
Instructional Design and Organization	-Setting curriculum -Designing methods -Establishing time parameters -Utilizing medium effectively -Establishing the netiquette
Facilitating Discourse	-Identifying areas of agreement/disagreement -Seeking to reach a consensus/understanding -Encouraging, acknowledging, or reinforcing student contributions. -Setting a climate for learning -Drawing in participants, prompting discussions -Assessing the efficacy of the process
Direct Instruction	-Present content/questions -Focus the discussion on specific issues -Summarize the discussions -Confirm understanding through assessment and explanatory feedback -Diagnose misconceptions -Inject knowledge from diverse sources, e.g., textbook, articles, the internet, personal experiences -Responding to technical concerns

In the design and organization category, the indicators of teaching presence begin to appear before the course. These indicators include building curriculum materials, setting syllables, and designing learning environments and learning activities. In the facilitating discourse category, the indicators include critical teacher activities in online environments for meaningful learning outcomes. In the CoI framework, Anderson et al. (2001) specifically used "discourse" rather than "discussion" to emphasize deep and continuous communication. This category includes the purpose of encouraging individual and community learning. In the direct instruction category, the role of the teacher changes to facilitating the direct sharing of subject information with students. In this category, teaching presence indicators come to the fore with teachers' expert and leader identities. According to Garrison and Anderson (2003), teaching presence "is not possible without the expertise of an experienced and responsible teacher who can identify the ideas and concepts worthy of study, provide the conceptual order, organize learning activities, guide the discourse and offer additional sources of information, and diagnose misconceptions and interject when required" (p.71). Garrison and Anderson (2003) argued that teaching presence regulates and mediates all elements of a community of inquiry in a balanced and useful relationship. In 2006, Shea et al. discussed that an efficient teaching presence increases the level of community development in online learning environments. For example, they argued that active and collaborative learning activities can be managed with the teaching presence. The teaching presence is vital to advancing learning toward worthwhile outcomes (Kraut, 2021).

It was important that this element is called teaching presence, not teacher presence. This is because, while the teacher provides purpose, structure, and leadership, especially at the beginning of a course, as a course progresses, students will begin to take ownership and teach and learn from each other as well as the teacher (Garrison, 2017). Similarly, Anderson et al. (2001) emphasized that teaching presence roles and responsibilities can be shared among the teacher and learners. In their research, they examined online courses and found that the learners performed an important part of the teaching presence role. For example, students helped each other when there is a technical need, they gave feedback to their peers, and they encouraged each other's to

participate in discussions. Palloff and Pratt (2001) also suggested that the teacher in online environments should give responsibilities such as giving feedback to learners in the teaching and learning process to be able to build a learning community. In line with this, Rourke and Anderson (2002b) explained that it can be difficult to fulfill the role of teaching presence by the instructors themselves. In their study, the authors examined the difference and similarities between the performance of peer teams and the instructor's role in their teaching presence experiences. They find out that most of the learners explained their preference for peer teams as they found them more active, structured, and interesting (Rourke and Anderson, 2002b). Moreover, they argued that instructor-led discussions can put the students in a passive role. However, Rourke and Anderson (2002b) argued that the direct instruction category of teaching presence should be performed by the instructor since the category needs expertise. Arbaugh and Hwang (2006) also emphasized that although facilitating discourse and design and organization categories can be performed by someone who has these skills, the direct instruction category can be provided by only content experts.

In the literature, there are many studies that emphasize the important role of teachers and teaching presence in online learning environments for successful community development. For example, Shea et al. (2004) found that students' satisfaction and learning are highly correlated with the teaching presence in online learning. They explained that students who reported having a high level of satisfaction and learning also reported a high level of teaching presence indicators. In their later study, Shea et al. (2006) show that there is a relation between learners' perceived level of teaching presence and their sense of being a learning community. In 2021, Anderson et al. (2021) found that when teaching presence is applied effectively, students' outcomes become sustainable and significantly improved. In 2021, Wang et al. conducted a study to explore students' and teachers' perceived teaching presence by surveying 1041 students and 18 teachers in an online course at a Chinese University. They found that students perceived level of teaching presence is significantly lower than teachers, especially for facilitating discourse. According to results, they indicated that teachers need to pay more attention to macro-level comments on courses, design instructional

methods, provide formative feedback for homework and discussions, and make full use of technological tools in teaching to improve students' online learning experience. In 2021, Özüdoğru conducted a study with 262 pre-service teachers from different fields to reveal pre-service teachers' perceptions of CoI according to gender and their departments. She found that female pre-service teachers exhibited considerably greater teaching presence and cognitive presence scores than males and no difference among departments. They also found that teaching presence was a key factor and was associated with perceived social and cognitive presence, instructor support, active learning, student interaction and collaboration, and autonomy characteristics of distance education teacher education classroom environments (Özüdoğru, 2015). Moreover, teaching presence is found as a regulator element of CoI framework which brings "all the elements of a community of inquiry together in a balanced and functional relationship congruent with the intended outcomes and the needs and capabilities of the learners" (Garrison and Anderson, 2003, p. 29). In 2003, Shea et al. developed an instrument to explore students' perceptions of teaching presence based on categories developed by Anderson et al. (2001). Later, the final version of the teaching presence survey was developed with thirteen items in the Community of Inquiry Survey (Swan et al., 2008). In this study, the CoI Survey was used.

In summary, teaching presence has an important role in online learning environments to be able to develop online learning communities. Garrison and Arbaugh (2007) explained that teaching presence has an effective and unifying role in building a community of inquiry.

2.3.2. Social Presence

Social presence is not a new phenomenon in online learning environments. There is increasing attention to social presence in online learning research (Gunawardena and McIsaac, 2003). Short and Williams (1976) first conceptualized social presence, and Christie (1976) and defined it as "the salience of the other in a mediated communication and the consequent salience of their interpersonal interactions." According to

Short et al. (1976), there are two components of social presence: intimacy and immediacy which are closely related. Intimacy is defined as the feeling of connectedness during an interaction. Immediacy is defined as the psychological distance between communicators. Intimacy and immediacy are indicated by both verbal and nonverbal cues such as physical proximity, eye contact, and gestures (Gunawardena and Zittle, 1997). Short et al. (1976) argued that some technological tools are more effective to deliver these cues, while others are not. Their results suggest that levels of intimacy and immediacy in visual tools are much higher than in non-visual tools, and so social presence is the highest. They argued that "the absence of visual channels reduces the possibilities for the expression of socio-emotional material and decreases the information available about the other's self-image, attitudes, moods, and reactions" (Short et al., 1976).

The perspective of social presence determined by the technological environment has continued to be a source of research. These studies examined whether people experienced different levels of social presence within specific mediums (Lomicka and Lord, 2007). For example, Daft and Lengel (1986) explained media richness theory which claims certain technological tools are more appropriate for reaching social presence. In another study, Lomicka and Lord (2007) examined the level of social presence through three groups that used different technological tools. These groups were traditional, dialogue, and group. In traditional students wrote their journals and submitted them for credit without feedback. In dialogue, students send their journals to their partners through e-mail dialogue. In groups, students used discussion boards to submit and discuss their journals. The researchers show that these different group environments have different levels of social presence. They conclude that the use of tools of mail communication and online discussions impacted the development of social presence (Lomicka and Lord, 2007).

On the other hand, some researchers rejected medium-centric views of social presence (e.g., Ramirez et al., 2002; Antheunis et al., 2010). For example, Walter (1992) argued that social presence experiences are highly related to the interactants

rather than the environment itself which is known as social information processing theory. Walter (1996) expanded this theory and showed that individuals in text-based communication environments, in some cases, achieve higher levels of social presence than individuals in face-to-face environments. In another example, Rogers and Lea (2005) criticized the idea of fewer visual or audio clues lead to less social presence. In their approach which is the Social Identity model of de-individuation effects, they argued that deficiency of tacit cues in distance environments may raise the level of social presence rather than decrease it. This model has associated with the creation of social presence with a sense of belongingness to the group, shared purpose, and collaboration.

In the CoI framework, social presence is viewed as an important element to develop community and collaboration in online environments, so it becomes an integral part of the CoI framework (Swan, 2009). Garrison et al. (2001) defined social presence as the ability of learners to project themselves socially and effectively into a community of inquiry. Rourke et al. (2001) defined social presence as the ability of learners to present themselves as "real people." Social presence is also defined as "the ability of participants to identify with the community, communicate purposefully in a trusting environment, and develop interpersonal relationships by way of protecting their individual personalities" (Garrison, 2009, p.352). In the CoI framework, social presence is identified as 12 indicators in three categories based on previous research as shown in Table 2.2 (Rourke et al., 2001).

Table 2.2. Social presence indicators.

Categories	**Indicators**
Affective responses	-Expression of emotions -Use of humor -Self-disclosure
Open communication	-Continuing a thread -Quoting from other's messages -Referring explicitly to each other's messages -Asking questions -Complimenting/expressing appreciation -Expressing agreement
Cohesive responses	-Vocatives -Referring to the group using inclusive pronouns (e.g., we, us) -Phatics/salutations

In the literature, there are many studies that examine the relationship between social presence and learning (Tu and McIsaac, 2002; Richardson and Swan, 2003; Swan and Shih, 2005). For example, Tu (2000) found social interaction fundamental to the explanation of the relationship between social presence and the social learning theory. According to Tu (2000), the relationship between social presence and course design is based on social learning theory such as social context, online communication, and interactivity. In 2020, Daigle and Stuvland described social presence as a best practice for successful learning experiences in online environments. They explained two findings to maximize social presence in a blended synchronous or asynchronous environment as a best practice of online education, especially for uncertain futures and global pandemics. The sense of "being there" and "belonging" in online environments is crucial for social presence. The social presence studies mostly used questionnaires (Picciano, 2002; Richardson and Swan, 2003). In 2002, Tu developed a survey that measures social presence as social contact, communication, and interaction. Within

the CoI survey, social presence was evaluated with 9 items based on social presence indicators developed by Rourke et al. (2001). These indicators are also used in studies that apply content analysis of discussions to explore social presence (e.g., Akyol and Garrison, 2008).

2.3.3. Cognitive Presence

Garrison, Anderson, and Archer (2001) defined cognitive presence "as the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry." Reflection refers to the ability of critical thinking and discourse refers to purposeful and trusting interactions. In other words, cognitive presence is based on critical reflection and discourse to get higher-order thinking and learning (Garrison, 2010). Garrison et al. (2000) determined cognitive presence as the most important criterion for important achievements in higher education. Garrison et al. (2001) explained cognitive presence using the Practical Inquiry model. The model is shown in Figure 2.2.

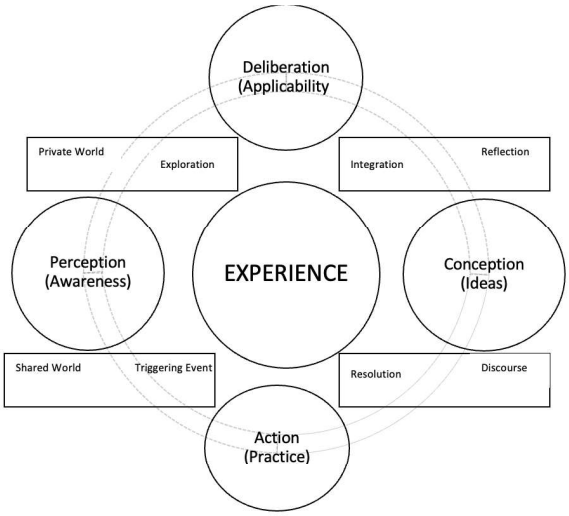

Figure 2.2. Practical Inquiry model.

Practical Inquiry (PI) is a cyclical and two-dimensional model. These two dimensions are action-deliberation and perception-conception. The development of cognitive presence has grounded the integration of the public and private worlds of the learner for educational purposes. The vertical and horizontal dimensions of Practical Inquiry indicate inductive-deductive and divergent-convergent operations of critical thinking (Garrison, 2000). In addition to these two dimensions, a practical inquiry has four phases to describe cognitive presence in a community of inquiry (Garrison and Anderson, 2003). The first phase is triggering the event. This phase includes engaging students with a well-thought-out activity to initiate the inquiry process. The second phase is an exploration that focuses on understanding the nature of the problem. The third phase is integration. This phase includes the integration of ideas in a focused and structured way to construct meaning. The last phase is resolution. This phase includes the resolution of the problem. A description of cognitive presence categories is presented in Table 2.3. There are many studies that use the PI model to examine cognitive presence (e.g., Vaughan and Garrison, 2005; Kanuka et al., 2007).

Table 2.3. Cognitive presence indicators.

Phase	**Descriptor**	**Indicator**
Triggering event	Evocative	-Recognize Problem -Puzzlement
Exploration	Inquisitive	-Divergence -Information Exchange -Suggestions -Brainstorming -Intuitive leaps
Integration	Tentavi (Convergent)	-Convergence -Synthesis -Solutions
Resolution	Commited (Deductive)	-Apply -Test -Defend

In conclusion, online and blended learning is increasing with the changing needs and technological developments. Therefore, there is a need to explore the experience of teaching and learning in online environments. In 2000, Garrison et al. developed the Community of Inquiry framework to explain learning in online and blended environments. The framework explains that the learning experience occurs within the community with the intersection of teaching and social and cognitive presence. It is explained that the CoI framework provides a systematic perspective and guide to studying online education (Garrison and Archer, 2007). The literature shows that these presences have a close relationship, and they are interdepended. For example, Garrison and Arbaugh (2007), connected the three presences of the CoI framework: "Social presence lays the groundwork for higher-level discourse; and the structure, organization, and leadership associated with teaching presence creates the environment where cognitive presence can be developed" (p. 163). The social and teaching presences of the CoI framework were found critical for the development of cognitive presence (Shea

and Bidjerano, 2009). For example, creating a comfortable environment with a social presence is important for the growth of cognitive presence (Shea and Bidjerano, 2009). Vaughan and Garrison (2005) emphasized the importance of teaching presence for the development of cognitive presence. Therefore, it is important to explore how students and teachers experience these presences. Specifically, teaching presence is expressed as a critical element of the CoI framework with the regulatory role between other presences (Garrison and Anderson, 2003, p. 29). Shea et al. (2006) also suggested that teaching presence elements can orchestrate the process of active learning by supporting constructing community among online learners. Studies showed that teaching presence is crucial for developing a community of inquiry. Therefore, there is a need to understand online learners' and the instructor's experiences in the teaching presence of CoI.

3. SIGNIFICANCE OF THE STUDY

In the literature, online education was defined as a method of teaching and learning by using asynchronous and synchronous communication technologies. If the teacher and students are different in time and location, then the type of distance education is asynchronous (Manzanares and Barbour, 2010). In addition, blended learning is defined as a combination of learning delivery methods (So and Brush, 2008). There is no consensus on what instructional designs regarded as blended learning might be and there is a variety of mixes in blended learning environments (Garrison and Kanuka, 2004; Osguthorpe and Graham, 2003). In fact, Garrison and Kanuka (2004) said that "no two blended learning designs are identical." In this study, the focus was a blended mathematics teacher education course that includes face-to-face and asynchronous components with several practices. Moreover, the course content was teaching mathematics with technology. Although the elements of CoI developed by Garrison, Anderson, and Archer (2000) have been researched and approved by many studies, the focus of the study which was asynchronous components of an applied blended mathematics teacher education course is unique in nature. In addition, this study focused on the teaching presence construct of CoI. Teaching presence is the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes (Anderson et al., 2001). The beginning of the teaching presence construct of CoI is based on the pre-course preparation such as the design and plan of the instruction. Then, teaching presence continues during the course with facilitation and direct instruction when needed (Anderson et al., 2001). There are few studies that focus on teaching presence element in asynchronous environments (Flener-Lovitt et al., 2020). This study explored teaching presence in the asynchronous environment.

Another contribution of this study to the CoI framework will be the exploration of the experiences of pre-service mathematics teachers and the teacher educator in terms of teaching presence. For teacher education, the blended learning and teaching

approach is a relatively new field of practice and study (Keengwe and Kang, 2013). This trend toward blended forms of teacher education has accelerated in the context of Covid-19 and led providers to review their processes (La Velle et al., 2020). Also, the literature suggested that blended teaching and learning implementations are an increase in the faculties of education in Turkiye (Aksu and Atmacasoy, 2018). After Covid-19 there were new and innovative approaches to teacher education (Scull et al., 2020). There are previous studies that examine the perception of CoI of pre-service teachers (Özüdoğru, 2021). This study aims to explore their experiences with teaching presence.

In order to explore pre-service mathematics teachers' experiences of teaching presence in the asynchronous components of the blended course, multiple data sources and perspectives were examined throughout the study. Gunawardena et al. (2021) recommended using diversified data sources to explore the complex nature of blended learning environments. This study purposed to gain a deep understanding of the experience of teaching presence of CoI framework with data from a variety of sources.

4. STATEMENT OF THE PROBLEM

The purpose of this research was to explore the experiences of pre-service mathematics teachers on teaching presence element of the Community of Inquiry Framework in the asynchronous learning environment of a blended undergraduate teacher education course with several practices. The research question of the study is:

RQ: How did the students (preservice mathematics teachers) experience teaching presence in asynchronous components of an undergraduate blended course?

5. METHODOLOGY

The main purpose of this research was to explore teaching presence in the asynchronous component of a blended course from the perspective of both students and the instructor. This research had a qualitative research design. A qualitative approach is most useful for this research since it allows us to explore participants' experiences in their natural settings (Creswell, 2003). In this respect, a qualitative research approach was implemented to explore the experiences of learners in terms of teaching presence in an asynchronous component of the blended undergraduate course which includes several practices to design this asynchronous component. Several practices refer to activities that the instructor planned with different asynchronous learning tools and environments such as Perusall, Moodle, WhatsApp, and GeoGebra. The case study method allows the researcher to explore the case within context (Saunders et al., 2012). Therefore, the study used the case study design and multiple data sources to investigate research questions. The case of the study was the asynchronous component of a blended undergraduate course at a state university in Istanbul. In the fall semester of 2022, the Higher Educational Council of Turkey made face-to-face education compulsory for universities. However, there were a couple of courses that will include asynchronous components in the University. The researcher meets with the instructors of these courses and selected one of these courses based on the purpose of the research. There were several reasons for selecting this course as the case of the research study. Firstly, in this course, there was an asynchronous experience with several practices with several tools. Secondly, this course's instructor has been using asynchronous activities before the pandemic for that course. Lastly, this course's instructor was very knowledgeable and experienced with technology so this can reduce the technical problems of implementing online teaching.

5.1. Settings and Participants

The asynchronous components of an undergraduate course were examined for this study. The asynchronous components of this course were the case of the study. The course was one of the required courses for preservice mathematics teachers to learn how to teach mathematics in the fall semester of 2022 in Istanbul. This was an applied course which means the course focused more on practical implications. Students were expected to attend class sessions. In the course, students experienced different methods to teach mathematics using several technological tools. There were individual and group assignments and one final project. After permission was received from the ethical committee for data collection, a semi-structured interview was conducted with the course instructor one day before the course began to be able to understand how the teacher educator designed and planned the course for the fall semester of 2022.

The teacher educator has been teaching this course for ten years. In order to meet with the instructor and introduce the study, I had a 30-minute synchronous meeting with the instructor through Zoom. I asked how the teacher educator designed this course and which tools would be included especially for the asynchronous component of the course. The instructor explained that this course would be a blended course with face-to-face classes and asynchronous components that includes several practices. The first practice of the asynchronous environment would be a social annotation activity on Perusall which means the participants will read, discuss, and highlight assigned readings collaboratively while reading. The teacher educator had used this platform in her/his previous courses and had positive feedback from students who experienced Perusall, so decided to use this tool for this course. For the instructor, using tools that students already know takes priority over new tools. Another reason to prefer Perusall was the feature of showing real-time analytics of the tool. Perusal shows real-time analytics about the class's engagement in the assignments and shows data to explore students' performance. Moreover, this tool was giving data about users' activity on the platform such as their reading time, their number of comments, and the most active students. The teacher educator said that seeing which students are

most active and which are not, also seeing which topics students discussing is important because these data can also give an idea about face-to-face classroom discussions. I asked whether the instructor would prefer to join discussions on Perusall or not. The instructor noted that generally, she/he doesn't prefer to join discussions in order to avoid affecting students. However, the instructor explained that she/he planned some face-to-face class sessions to open, discuss and summarize Perusall comments. This means that there were interactions between asynchronous and face-to-face components of the blended course.

In the pre-interview, the teacher educator explained that the second practice of the asynchronous component was not designed at that time. It might be a GeoGebra activity or a social media discussion. She/he said that the design of this part was continuing. After the course, in the post-interview, the instructor explained that the GeoGebra activity was used as the second practice, and social media discussions were not implemented. This is because the instructor could not find a beneficial social media environment for the students. The researcher asked which learning management system (LMS) was preferred for the course. The instructor explained that there is no big difference between LMS tools, she/he used Moodle which is also the official LMS of the University and students already know to use this tool. Moreover, the instructor explained that although the forum or discussion features of LMS are not useful because these environments are highly official, there will be a forum on Moodle for answering students' questions. She/he said that "using WhatsApp or social media platforms for discussions might be more useful. if I can find an educational tool that students easily access with phones like WhatsApp, then I can add this course." However, the instructor did not find such a tool and did not use WhatsApp at the beginning of the course because WhatsApp was not a learning tool. On the other hand, towards the end of the semester, the instructor noticed that the students did not use the forum on Moodle, then opened a WhatsApp group for meeting students' needs. Also, permission was received from all students on the WhatsApp group to observe their experiences.

I asked about the instructor's previous experiences with online or blended learning. The teacher educator explained that in the 2021-2022 academic year, she/he has given this course online because of the Covid-19 pandemic. This online course included synchronous classes on Microsoft Teams, she/he was also using Teams as LMS at that time. In addition to that, the instructor designed asynchronous activities such as discussion groups on Twitter. Specifically, the instructor explained that previous online versions of this course were very successful. However, this semester the fully online lessons were prohibited by Higher Education Council in Turkey, so she/he had to include face-to-face classes for this course. If there was no obligation for face-to-face courses, the instructor will make this course fully online. At the end of the pre-interview, I asked again about the current design of the asynchronous component of the course. The teacher educator said that the organization and design are continuing, probably the course will include more asynchronous components in the second part of the semester. Because of that, the meetings with the instructor continued throughout the semester to be able to learn more about plans and designs.

The total number of students was 42 in the course, 39 students were middle school mathematics preservice teachers, two students were high school mathematics preservice teachers, and one student is from the mathematics department. There were 31 senior students in the course. The number of senior students was important because they experienced most of their college education online starting from their second semester to the seventh semester because of the Covid-19 pandemic. In this university, the undergraduate program in primary mathematics education included three required mathematics courses, one education course, two physics courses, one introduction to mathematics teaching course, and three elective courses in the first year. In the second year, there are two mathematics courses, one physics course, two education courses, and one instructional method for teaching mathematics courses. In the third year, there are instructional technologies courses, a special education course, and six departmental courses which are teaching methods, statistics, community service, teaching probability, teaching geometry, and teaching mathematics. In the last year, there are a classroom management course, five departmental courses which are measurement and assessment,

research methods, digital technologies in teaching mathematics, and two internship courses. In Turkey, universities were transferred to fully online education in the 2020 spring semester because of the Covid-19 pandemic. In the 2021 spring semester, the educational activities were mostly online. Therefore, the student participants of this study experienced most of their college education online starting from their second semester to the seventh semester because of the Covid-19 pandemic.

5.2. Data Collection and Procedure

In this study, the participants were the students and the teacher educator. Considering the data collection tools based on the research question for these participants, Table 5.1 summarized.

Table 5.1. Research question and data sources.

Research Question	**Data Sources**
How did the students (preservice mathematics teachers) experience teaching presence in asynchronous components of an undergraduate blended course?	**Primary** -Community of Inquiry Survey -Individual Interviews with selected students **Secondary** -Online Learning Environment Postings and Discussions -Pre-Interview about designing the course with the instructor -Post-Interview about the evaluation of the course process with the instructor

Online learning environments have a complex nature, so using multiple data sources to understand groups' and individuals' learning experiences is essential (Gunawerdena et al., 2001). Since the purpose of this study was to gain deep insights into students' experiences in terms of teaching presence in this rich asynchronous learning

environment, the study included different data sources. The main data sources were student interviews and the Community of Inquiry Survey. The secondary data sources were online discussions and postings, the interview with the instructor, and classroom observation notes. The asynchronous component of this blended course had several practices and online tools such as Moodle as LMS, GeoGebra, and Perusall. Moreover, collecting multiple data using different strategies might decrease the limitations of every single strategy and might increase validity and reliability (Tashakkori and Teddle, 2003). The procedure of data collection was conducted. Before the course begin, a semi-structured interview was conducted with the course instructor. During the semester, the researcher was an observer participant in the asynchronous environments, and postings and discussions were observed and noted as suggested data sources. Also, I observed some face-to-face classes which includes interactions with asynchronous components and these observation notes were secondary data sources. After the asynchronous components of the course ended, students were asked to answer the CoI Survey. The survey was applied in a face-to-face class and delivered to absent students using an online survey platform. 26 students participated in the survey. At the end of the semester, the students who were selected and agreed to participate were interviewed. Five voluntary students were selected and interviewed according to CoI survey results. The criteria for participants were selecting mixed scores who had low, medium, and high scores. In addition, the course instructor was interviewed at the end of the semester.

5.2.1. Community of Inquiry Survey

The CoI Survey was applied at the end of the semester. The aim of the survey was to examine students' experiences with teaching presence and other presences since they were related to teaching presence. The CoI survey was developed and validated by Arbaugh, J.B., Cleveland-Innes, M., Diaz, S.R., Garrison, D.R., Ice, P., Richardson, and Swan, K.P. in 2008. They found Cronbach's Alpha equal to 0.94 for Teaching Presence, 0.91 for Social Presence, and 0.95 for Cognitive Presence (Swan et al., 2008). The CoI Survey is an open resource under the Creative Commons license (CC-BY-

SA). There are many findings about online and blended learning environments in the studies supported by the CoI survey. For example, the survey is used to evaluate the use of a specific tool or method in a course (e.g., Ozturk, 2015) or to guide design (eg., Akyol et al., 2011). Akyol et al. (2009) compared online and blended delivery methods by using a CoI survey and found a Higher perception of CoI in blended environments. On the other hand, the survey was used to compare synchronous and asynchronous interactions. While Rockinson-Szapkiw et al. (2015) found a higher level of CoI in synchronous interaction, Rockinson-Szapkiw (2012) found no significant difference. In 2018, Stenbom combined the results of 103 studies that use the CoI survey and indicated that the CoI survey provides a reliable and valid measure of cognitive, social, and teaching presence as outlined in the CoI framework. In this study, 26 students in the online course completed the survey in English. In order to get detailed information about students teaching presence experiences eight open-ended questions have been added at the end of the survey. These questions were prepared and added by the researcher. There were thirty-four Likert-type questions that uses a 5-points scale. In this Likert scale survey, 1 point was used for strongly disagree, 2 points for disagree, 3 points for neutral, 4 points for agree, and 5 points for strongly disagree.

5.2.2. Interviews

Patton (1990) defined interviews as the most effective strategy to get depth insights. In this study, semi-structured interviews with the students and the instructor were conducted to examine their experiences in depth. The semi-structured interview was preferred because it allows the researcher to explore, probe, and ask additional (Yıldırım and Şimşek, 2005). A semi-structured interview was conducted with the course instructor before the course begin. The interview questions were prepared by the researcher and pilot testing was done before the interview. The interview took about 30 minutes. During the interview, the instructor's implementations of the asynchronous courses were covered. Also, a semi-structured interview was conducted with the course instructor at the end of the course. The interview questions were prepared by the researcher and pilot testing was done before the interview. The interview took

about 30 minutes. During the interview, the instructor's experiences and implications with the teaching presence were covered. The researcher emphasized exploring how the instructor experienced teaching presence through asynchronous implications in the course and similarities and differences with students' experiences and perceptions about the teaching presence of asynchronous communities of inquiry.

In the student interview, students who were the participants of the semi-structured interview were determined by applying the CoI survey. According to survey results, six participants were invited for interviews, and it was conducted voluntarily participating. The first interview was used to pilot the interview questions. After the pilot interview, the interview questions were updated, and then five participants were interviewed. A semi-structured interview was conducted with these five students at the end of the term to get detailed information about their experiences and perceptions of the teaching presence of the course. The interviews were individual interviews and conducted through synchronous online meetings on Zoom. These interviews were voice recorded and transcribed. For the interview transcription, the Google Speech-to-Text tool was used. For the coding process, MAXQDA was used as a coding tool. The transcription of interviews was coded. The open coding process was applied as the coding strategy of the study by the researcher. Also, a different researcher coded some parts of the transcript to test agreement for inter-rater reliability. After all data were open-coded, and the researcher went over the codes, selected those that were frequent, and combined the less frequent ones into the selected ones, when appropriate. Then, these new codes were categorized, and the researcher examined whether the themes of teaching presence described in the CoI framework emerged according to these categories. The existing teaching presence categories and indicators completely matched the interview codes.

5.2.3. Online Postings and Discussions

The online course had asynchronous components. The suggested data were collected from students and the instructor's posts and discussions on the tools such as

Perusall, Moodle, GeoGebra, and WhatsApp. These online posts came from different practices and different tools. The online postings included discussions and comments on Perusall, announcements, and forums on Moodle, assignments, and group projects on GeoGebra, and chats on WhatsApp. In the Perusall, participants annotated their comments on readings by highlighting the related parts. In Moodle, there were announcements of the instructor and forums on students' questions. In WhatsApp, there were discussions, questions, and answers. The researcher was an observer participant in these learning environments. Each post from different practices was read as the suggested data source.

5.3. Data Analysis

5.3.1. CoI Survey

Descriptive statistics were used to find the students' level of experience teaching, and social and cognitive presence. Then for each presence, the descriptive statistics were analyzed to see data patterns and to calculate average scores. To be able to indicate students' experiences with each presence, the median and mean scores of the questions for each presence in the survey were computed. The analysis indicated that students experienced high levels of each presence.

The survey included eight open-ended questions. Twenty-six students in the course answered the open-ended questions. In general students' responses about their asynchronous learning experience were positive. These open-ended questions were read by the researcher and used as suggested data sources.

5.3.2. Students Interview

The interviews were recorded and were later transcribed to prepare data for analysis. All the transcription was read to understand all data. Then the open coding process was applied for each interview (Appendix B). The main question asked to

students was how they experienced the asynchronous components of the course. In addition to that the questions asked to students such as how they experienced design and organization in the asynchronous components, how they experienced the facilitator role of the instructor in the asynchronous components, and how they experienced direct teaching in the asynchronous components. The main question and additional questions asked to students to understand how they experienced the teaching presence construct of the CoI framework during the asynchronous components of the course. Moreover, if students talk about face-to-face components while answering questions during the interview, the researcher warned them to answer by considering the asynchronous side. Although the main questions related to teaching presence construct of CoI. There were codes released in addition to the teaching presence. Therefore, the emerged codes grouped as interaction with tools, content, and components of CoI: social presence, cognitive presence, and teaching presence. These categories inside analyzed with different coding strategies. In addition, there were some instances in the transcripts that included more than one code and category.

In the interaction with tools category, to explore the interaction between the tools and the asynchronous environment open coding process was applied to interview transcripts. Moreover, an open coding process was applied for each tool separately to be able to understand which tool affected how. There were five main tools that were used in the course. The codes emerged for each tool differently. These codes created common themes among the tools. There were two common themes emerged in the interaction with tools: Learning Experience and Features of Tools. The codes for each tool, common themes, and some examples for each code are indicated in the following Table 5.2. There were 6 codes for the learning experience and 12 codes for features of the tool theme. The learning experience theme is defined as the students' learning interactions during the asynchronous learning environment through technological tools. The features' theme is defined as the student's interactions with the features of the tools.

Table 5.2. Interaction with the tools cagetory's themes and codes.

Theme	**Codes**	**Tools**	**Freq.**	**Some Examples**
Learning Experience	Interaction with the Instructor	WhatsApp	16	-Our teacher helped us a lot in WhatsApp groups (Participant 2).
	Interaction with peers	WhatsApp	15	-The WhatsApp group where we became more interactive with each other and were able to answer each other's questions (Participant 4).
	Learning from instructor's examples	GeoGebra	5	-It helped us to have the teacher's own page here and how the teacher progressed one by one (Participant 3).
	Collaboration	Perusall	12	-In Perusall we guided each other in the form of comments and feedback, we received help and enriched each other (Participant 5).
	Learning Management	Moodle	3	-The Moodle environment is a more stable environment where we can directly access, certain parts of the answer to our question, and it is more organized. (Participant 4).
	Asking question	Mail	4	-I have received direct answers to the questions I have asked via e-mail (Participant 4).

Table 5.2. Interaction with the tools category's themes and codes. (cont.)

Theme	**Codes**	**Tools**	**Freq.**	**Some Examples**
Features of the Tool	Quick communication	WhatsApp	5	-WhatsApp group was used very quickly everyone was getting back to each other really fast if they know answer (Participant 3).
	Overlooked	WhatsApp	2	-There are lots of messages in the flow of WhatsApp so there is a possibility that some messages may be missed (Participant 4).
	Complicated	GeoGebra	5	-When you enter GeoGebra there is a very complex page (Participant 1).
	Technological	GeoGebra	1	-GeoGebra was also a perspective on technology (Participant 2).
	Professional development	GeoGebra	3	-I even used GeoGebra in my lectures at the school where I did my internship (Participant 5).
	The monitored Environment	Perusall	4	-My teacher there can clearly see something I did online in Perusall in other words, she/he was observing what we did, what we wrote, how much we read and so on (Participant 3).
	Pleasant	Perusall	5	-I enjoyed reading the readings with Perusall. (Participant 2).

The second category that emerged from interview transcriptions was Content. In the open codes, there were examples in which the students refer to the content of the course. These open codes created two themes: The design of the course and The application of the course.

The last group was the Components of CoI. The open coding process applied to interview transcripts and some emerged codes grouped as Components of CoI. Then the codes in the group were categorized as social presence, cognitive presence, and teaching presence. In the teaching presence category, to be able to explore students' experiences of teaching presence, an inductive data coding process was conducted using emerged codes of teaching presence. The codes that emerged were parallel with the CoI framework's teaching presence codes. Teaching presence categories are design and organization, facilitating discourse, and direct instruction. For each category, the indicators and examples derived from the interview transcripts are shown in Table 5.3 for design and organization, in Table 5.4 for facilitating discourse, and in Table 5.5 for direct instruction categories. However, for teaching the presence of CoI, the instructor needs to state it deliberately. In other words, only emerging it in the student's or the instructor's interview does not prove that it is the teaching presence of CoI. For this reason, instead of the interview data with the instructor, the researcher examined the interactions between the students and the instructor in the asynchronous learning environment as a secondary data source. Tables 5.3, 5.4, and 5.5 includes the instructors' example sharing as suggested data from Moodle, Perusall, WhatsApp, and Mail. In the examples, students' real names are not used to avoid ethical concerns.

Table 5.3. Design and organization category's indicators and some examples.

Indicators	**Some Examples from Interview**	**Some Examples from Instructor's Sharings**
Setting curriculum	There is a clear syllabus (Participant 5). It's clear what we should do (Participant 2).	You are supposed to design a ..... to achieve .... (Moodle). I will assign .....to you for this week (Mail).
Designing methods	There was a flow to explore the tools there, then we need to make inferences and plan what to use where and finally we come up with something to achieve our goal (Participant 4).	This assignment is for you to describe your current ideas and thoughts on technology integration in mathematics education (Moodle). Reflect on this assignment (Moodle).
Establishing time parameters	We had things to do in a certain time frame (Participant 2).	Due: Tuesday, 17 January 2023, 11:59 PM (Moodle). I check around 12 (WhatsApp) Postpone Deadline to tomorrow night (WhatsApp).
Utilizing medium effectively	There was also a flow where we enriched each other in the WhatsApp environment (Participant 4). The teacher was already observing what we did, what we wrote, how much we read, etc. (Participant 5).	Don't forget to help each other while I'm gone (WhatsApp). If you write your name in the WhatsApp information, it appears next to your number. This way it will be clearer who wrote what (WhatsApp).

Table 5.3. Design and organization category's indicators and some examples. (cont.)

Indicators	**Some Examples from Interview**	**Some Examples from Instructor's Sharings**
Establishing netiquette	I think it's clear what we should do (Participant 2).	Try to be brief, to the point and ..... (Moodle).

Table 5.4. Facilitating discourse category's indicators and some examples.

Indicators	**Some Examples from Interview**	**Some Examples from Instructor's Sharings**
Identifying areas of agreement and disagreement	For example, when we wrote something to that group, the instructor wanted all our friends to look at that thing. We were helping each other in case there were different solutions (Participant 2).	For Peer Evaluation, I will send an equal number of applications to everyone. So, you will evaluate someone else's application (WhatsApp). The 2nd group practiced GeoGebra as .....Do you agree with this (WhatsApp).
Seeking to reach consensus	She/he wanted me to think about it by giving an example from the work of a different friend of mine, saying, how do you think you can transform this one here (Participant 4)?	If anyone wants to take a look, Emre's question and answer are related to this (WhatsApp). You are right ..... is not working (WhatsApp).

Table 5.4. Facilitating discourse category's indicators and some examples. (cont.)

Indicators	**Some Examples from Interview**	**Some Examples from Instructor's Sharings**
Encouraging, acknowledging, or reinforcing student contributions	The instructor was always pushing us. So, she/he was always pushing us mathematically (Participant 3).	You try to get to understand and bring to the surface your own ideas about... (Moodle). Thank you for trying Görkem:) (WhatsApp) The table part is a good idea (WhatsApp).
Setting climate for learning	I never really felt tense and stressed. I mean, it gave me that comfort and flexibility because I think the important thing was to learn for us as well as for our teacher (Participant 4).	This assignment is about you, so there are no right or wrong answers (Moodle).
Drawing in participants, prompting discussion	In our WhatsApp group, everyone was interested in each other's questions with the guidance of the teacher (Participant 3).	You may use this forum (Moodle). It makes me happy to support each other :D (WhatsApp). How do you think you can find a solution in this case (WhatsApp). C'mon, everyone who seeing this question find an answer to this question (WhatsApp).
Assessing the process	The teacher was there before the class, appearing online and reading the comments etc. (Participant 3).	Here are some I've never heard of. If we want to be a community, we are strong together. Is everything ok (WhatsApp).

Table 5.5. Direct instruction category's indicators and some examples.

Indicators	**Some Examples from Interview**	**Some Examples from Instructor's Sharings**
Present content/questions	The instructor was presenting a content aimed directly at the intended study and achievement in Perusall (Participant 5).	Perusall is ready to read together. This is the first week's reading (Perusall). Hint: the solution is in the screenshot I posted (WhatsApp).
Focus the discussion on specific issues	She/he was telling us we should use Perusall (Participant 1).	Now let's go through this example (WhatsApp).
Summarize the discussion	She/he was reading comments and so on, summarizing them in face-to-face classes (Participant 3).	In summary,... (WhatsApp).
Confirm understanding through assessment and explanatory feedback	The teacher was evaluating our projects with rubrics and giving feedback accordingly (Participant 4). In the WhatsApp group, when we had difficulties, our teacher would definitely look like this and give us feedback right away (Participant 2).	I did not understand your point with your comment. Would you write why you..... (Perusall).

Table 5.5. Direct instruction category's indicators and some examples. (cont.)

Indicators	**Some Examples from Interview**	**Some Examples from Instructor's Sharings**
Diagnose misconceptions	I did this but questioning whether I'm on the right step or maybe I've done wrong but the instructor made this lesson a relaxing lesson for me (Participant 1).	If you pay attention, when you create ....., it becomes ..... You may need to change the ... (WhatsApp). Your problem here is that you don't ..... (WhatsApp).
Inject knowledge from diverse sources, eg. (Textbook, articles, internet, personal experience)	While we were preparing homework, we looked at what the instructor did and her/his YouTube channel (Participant 3).	Click https://youtu..... link to open resource (Moodle). https://www.geogebr..... This example presents you with several ideas (Moodle).
Responding to technical problems	I was able to get a direct answer when there was a technical problem in the tools section (Participant 4).	After clicking ..., there is a ... button at the bottom left. You can press it once (WhatsApp). The zip file contains information about installing the ... program on your personal computer (Moodle).

Although the main question and additional questions asked students to understand how they experienced the teaching presence construct of the CoI framework

during the course, there were emerged codes for social presence and cognitive presence constructs of CoI. Therefore, rather than using an inductive coding strategy, the deductive coding process is conducted by matching open codes of social and cognitive presence and indicators of the CoI framework. Social Presence indicators and some examples from student interviews for each indicator are presented in Table 5.6. Cognitive Presence indicators and some examples from student interviews for each indicator are presented in Table 5.7.

Table 5.6. Social presence categories, indicators and some examples.

Categories	**Indicators**	**Some Examples**
Affective responses:	Expression of emotions Use of humor Self-disclosure	When I put myself in the position of a teacher, for example, when I give lectures during internship.... (Participant 1).
Open communication	Continuing a thread Quoting from other's messages Referring explicitly to each other's messages Asking questions Complimenting/expressing appreciation Expressing agreement	Sometimes this was in the form of an answer, to a friend's comment or as an addition (Participant 4). We constantly asked each other questions during the day on WhatsApp (Participant 1).

Table 5.6. Social presence categories, indicators and some examples. (cont.)

Categories	**Indicators**	**Some Examples**
Cohesive responses	Vocatives Referring to the group using inclusive pronouns (e.g., we, us) Phatics/salutations	There was a flow where we enriched each other by saying that I agree with Begüm's comment and even I think:...(Participant 4).

Table 5.7. Cognitive presence categories, indicators and some examples.

Categories	**Indicators**	**Some Examples**
Triggering event	Recognize Problem Puzzlement	I become curious about what we can create (Participant 1).
Exploration	Divergence Information Exchange Suggestions Brainstorming Intuitive leaps	In fact, we need to think a little more broadly (Participant 1). Sometimes the teacher made us discover (Participant 3). We exchanged ideas with each other a lot (Participant 3). We exchanged ideas with each other a lot (Participant 3).
Integration	Convergence Synthesis Solutions	We had to deduce by focusing (Participant 4). Looking at each other, we connected ideas (Participant 1).

Table 5.7. Cognitive presence categories, indicators and some examples. (cont.)

Categories	**Indicators**	**Some Examples**
Resolution	Apply Test Defend	We tested and then organized our GeoGebra Project (Participant 3).

5.4. Role of the Researcher

During the study, the researcher was a non-participant observer in the asynchronous environment and took observation notes. In other words, the researcher was an observer participant in WhatsApp, Perusall, GeoGebra, and Moodle. Also, the researcher was a non-participant observer in some face-to-face classes to be able to stay in the research field for a long time for strengthening the validity. These classes were selected when there were activities related to asynchronous components of the course. Since the aim of the study exploring the experiences of students and the instructor in terms of an asynchronous environment, the researcher tried not to disturb the natural setting of the classroom as much as possible. The role of the researcher was introduced to students in the first class of the course by the researcher and permission was taken from students. In the semi-structured interviews with students and the instructor, the researcher asked additional questions to gain a deep understanding.

5.5. Trustworthiness

Triangulation is defined as using multiple methods or data sources in qualitative research to develop a comprehensive understanding (Patton, 1999). Triangulation has

been viewed as a qualitative research strategy to validate findings. In this study, multiple data sources were used to triangulate the data. Multiple data sources were student and instructor interviews, a community of inquiry survey, online postings in Perusall and Moodle, and observation notes on WhatsApp groups and GeoGebra. In addition to that, there were observation notes in some face-to-face classes. Some classes were intentionally observed because these were the classes that the instructor indicated to interact with asynchronous components. The CoI survey and the student interview were the main data sources. Observation notes from face-to-face classes, WhatsApp groups, Perusall, Moodle, and GeoGebra were secondary sources to suggest findings. The findings from main data sources suggested with suggested data sources.

Credibility is defined as the measure of the accuracy and correctness of the findings. To be able to ensure credibility, the researcher kept a study log during to study to document what had been done at the research site. Guba (1981) suggested triangulation and reflective journal-keeping strengthen credibility. In this research, gathering data from multiple sources also increased credibility.

Including reflective notes from multiple data sources also reduced the possibility of the presentation of biased data. In addition, an independent researcher coded a part of the data to ensure interrater reliability. The emerging codes were compared with the inter-rater codes. There was an agreement between codes by multiple raters.

Transferability is defined as the measure of whether the results of the study are applicable to other contexts, circumstances, and settings. The triangulation strategy also suggested the transferability of the results. Also, the codes are reviewed by the advisor and then organized again by the researcher to ensure transferability. In addition, the inter-rater Reliability strategy was used with an independent researcher.

6. ETHICAL CONSIDERATIONS

For ethical issues, Research Ethics Committee consent form was received from the university to construct this study. In the first face-to-face class of the blended teacher education course, the researcher introduced herself to the class and also introduced the aim of the study, the data collection procedure, and expectations from the students. The informed consent form was obtained from all participants to use their data from the survey, tools that were used in the asynchronous environment, and observation notes.

7. FINDINGS

In this section, the findings will be presented under three features of the asynchronous learning environment that emerged from students' interview data: content, interaction with the tools, and components of CoI. These topics were selected according to emerging codes and themes from interview data.

7.1. Content

The course, which was the focus of this research, is an applied laboratory course for pre-service mathematics teachers. The main purpose of this course is for pre-service mathematics teachers to learn technological tools. In the interview with the course instructor, she/he indicated that *"The statement of teaching a technological program is a very ambitious statement because a technological program was there specifically in mathematics, learning it means being able to use it in every way."* In addition to teaching technological programs the instructor explained that one of the most fundamental achievements of this course is that teacher candidates develop a perspective on educational technologies and technologies used in mathematics education. The instructor also supported this purpose by saying *"I wish they had their own philosophies. Part of building these philosophies might be to use it or not. Of course, I want them to have a position about preference, why they want to use it or not."* The content of the course was also one of the most highlighted codes when the students explain their learning experiences. To be able to understand how the content affected the participants' teaching presence experiences, the content category presented emerged two themes. The content category included the implementation of the course and the design of the instruction's themes.

7.1.1. Implementation of the Course

The first theme of the content category was the implementation of the course. In this teacher education course, the instructor explained the educational philosophy within the course content such that *"Since we are talking about technological programs in this lesson, the input of the person is much more effective and important. The philosophy of this course, there is a technological world, is to introduce this world and then leave it to the user."* In other words, the point of view of the instructor is primarily to present and introduce technological resources to the students and then the beginning of the discovery process of students. In addition to that she/he indicated that learner-centered perspective was the main purpose when designing the course. The instructor indicated that *"Since I think that learning is realized by the person, it is actually the students who own it. I have a viewpoint of sharing materials that are good for them and content that we think they will see, getting them to meet and get started."* Supporting this, all participants also highlighted that it was a lesson that made them discover the subject in the students' interview.

The instructor stated that these exploratory processes are implemented mostly on the asynchronous components of the course. In this discovery process, the instructor planned his/her position as a monitoring and controlling mechanism in the asynchronous environment. She/he explained that this role is determined by the design principles of the course. For example, when students work on GeoGebra *"I follow the students, but I am not involved. For example, I was not involved in GeoGebra. They did it anyway, the purpose was for them to practice there. When they came to the classroom, there was an environment where they could ask questions if they could not do it. My intervention in asynchronous is just designing the environment and following it, showing how I follow Plus I can enter and see who did it and who didn't."* On the other hand, the instructor mentioned that she/he did not always rigidly apply his monitoring and controlling point of view. For example, she/he indicated that *"I see my role in WhatsApp a little differently. I tried to be a little hesitant there again. There were places where I sent the solution directly, sometimes there were places where*

I gave hints for the solution, and sometimes when I delayed it, the students solved it. I already gave him the opportunity. I see my role here as a problem solver, that is, more actively involved."

The instructor explained that the reason for her/his role here is to make students feel that there is a teacher who can get answers when students ask questions. In addition to that the instructor argued that the questions asked, and the answers received constitute an intense learning environment at this point. On the other hand, the instructor planned some face-to-face classes in light of asynchronous components. She/he explained this process and her/his role such that *"I did not take an active role in the asynchronous part. I took part in the part of carrying the asynchronous part to the synchronous part."* In the observation notes, there were some classes that the instructor carried asynchronous components such as Perusall comments or GeoGebra projects to face-to-face classes. For example, in one of the face-to-face classes, the instructor opened Perusall comments in the class and students continued to discuss and the instructor summarized all discussion at the end of the class. In addition to the implementation of the course, the designs and plans for instruction emerged from the interviews.

7.1.2. Design of the Instruction

In this section, the design of the instruction theme of the content category is presented using interview findings. The design was also fundamental for the teaching presence of CoI since it is one of the main categories of teaching presence. This course is designed as a blended teacher education course which includes asynchronous components and face-to-face components. These components are organized with respect to learning outcomes. The instructor explained that asynchronous components are part of learning that students manage their learning process by themselves. She/he argues that students need to experience some part of the learning process by themselves. Moreover, the instructor also highlights that *"Part of the learning is on the side of my control in the classroom. Some of it should hang outside of this, but it still*

needs to be where my control is, and that's where the asynchronous parts are." In the design of asynchronous components, the first practice was a collaborative annotation activity. The instructor indicated that the course is not include a lot of reading material but the theoretical background is important for students. Therefore, the instructor designed a collaborative annotation environment using Perusall to be able to support students' development of a community within asynchronous components of the course and to increase the reading rate. In this environment, the instructor uploaded reading materials to the tool and assigned them to students, then monitored the learners' process. The instructor indicated this process such as *"It was a part that I thought was a place where they highlighted the book, wrote comments and asked questions."* In Perusall, the instructor stated that she/he designed an environment where the instructor did not participate in the discussions and did not comment on the course design so that everyone could form their own point of view. Perusall provided opportunities for students to interact with the text and with each other by using the tool's sharing and communication features. In addition, the instructor designed face-to-face lessons to be discussed over the Perusall readings to highlight the importance of the discussions there and to talk about what the students were discussing.

The second practice that was designed asynchronously was a teaching mathematics activity with dynamic mathematics software. The instructor used GeoGebra for this activity in the asynchronous environment. She/he explained the GeoGebra design such that *"GeoGebra's infrastructure was suitable for them to use dynamic mathematics software more systematically. I designed it asynchronously. The part they must do is the part where I follow them, but they can do it on their own time. It was also a place where I wanted to control the control inside that class in asynchronous time outside the classroom, I wanted to make sure what they did or how much they did."* When students have questions and need support, the instructor gives place to GeoGebra in the face-to-face environment. In addition to that, when students need social interaction to work on GeoGebra, WhatsApp groups were used for communication.

The third practice that the instructor designed for asynchronous environment was the place for students to ask questions. At first the instructor used the forum feature of Moodle. The instructor explained this practice such that *"There was a design of the forum in Moodle because I wanted them to share if they had questions."* However, the forum feature of Moodle was never used by students, then the instructor changed the design by opening a WhatsApp group when the course continues. The instructor explained this change such that *"WhatsApp actually, it wasn't something I designed at first, I didn't think I would do it much, but I was also aware that Moodle might not work enough or that the questions there might not come up. Therefore, the WhatsApp part was the application that I added a part of which will activate the students' asking questions."* In addition to that there were students who are asking questions to the instructor via e-mail, but the instructor wanted to reduce asking questions by e-mail by enabling students to ask questions on WhatsApp and to see common questions. The instructor's approach to teacher education is also affected by the design of the course. The asynchronous design of the course is based on the instructor's view such as *"In order to test the effectiveness of the environments and to provide some control, make the design and leave it to them, but in fact, there should be no need for much control, but this is not very possible. Therefore, when there is an environment where I can keep it under supervision, the number of people who do it increases because they are under the supervision of teachers."*

Overall, it was found that this course was designed for mathematics teacher education with a unique course design and implementation. The content and the aim of the course affected the design of the asynchronous activities. In fact, the instructor role and implementations in the asynchronous environments were content-specific. There were different strategies of the instructor for pre-service mathematics teachers to guide them in the asynchronous environment. In addition, the content affected the tool selection and implementation of the course. Moreover, the tools were one of the most highlighted codes in the student's interview. Therefore, the tools are presented in the next section.

7.2. Interaction with the Tools

Unexpectedly, although the main emphasis of the study was not the tools, the tools were highlighted many times by the students in relation to their learning experiences. Therefore, the interaction with the tools presented in this section because this interaction is important to explore students' teaching presence experiences. Students' learning experiences with the interaction of the tools that are used in the asynchronous environments are presented using students' interview results and suggested data sources. Although the main question asked to students was not related to tools, the responses of students included highlights on the tools that were used in the asynchronous environments of the course. There were different codes for each tool and common themes among the five main tools in the asynchronous components of the course. There are two common themes emerged: learning experience and features of the tool.

7.2.1. Features of the Tools

The first common theme emerged as features. The features' theme included codes in which students explained the interaction of tools and the asynchronous environment by referring to tools' features within the course. This theme is included 12 codes from different tools. These codes and technological tools are represented in the following Table 7.1.

Table 7.1. Features of the tools.

Codes	**Tools**
Quick communication Overlooked	WhatsApp
Complicated Technological Professional development	GeoGebra
The monitored Environment Pleasant Uninteresting content	Perusall
Not active use Organized Late reply	Moodle
Notifying	Mail

In WhatsApp, two codes emerged in the features theme: quick communication and overlooked in the interview. Three students highlighted that they get a quick reply when they ask a question through WhatsApp. For example, one participant indicated that *"WhatsApp group was used very quickly everyone was getting back to each other really fast if they know the answer"* (Participant 3). A student reasoned the quick communication feature by referring to instant messaging by saying *"I think WhatsApp is always with us, and I think we are more comfortable."* While participants indicate positively about the instant and fast communication feature of WhatsApp, they also talked about the limitations of this feature. One student highlighted the limitations of instant messaging such as overlooked messages. The student explained that *"There are lots of messages in the flow of WhatsApp so there is a possibility that some messages may be missed"* (Participant 4). On the other hand, the instructor also indicated the limitation of instant messaging such as privacy. For example, she/he indicated that *"I do not want to share my phone number under normal conditions. It is not a very correct behavior professionally. I violate the work-life balance. but I continue with WhatsApp*

because this is the best solution I can find for now. I think I need to change this." There was an important example of the quick communication feature of WhatsApp such that the instructor announced a Moodle sharing through WhatsApp for students to look at Moodle. The mail tool was also used for communication and the notifying category emerged for Mail. One of the participants indicated that Mail was used for notifying students throughout the lesson.

GeoGebra is dynamic mathematics software and includes class activities, graphing geometry, collaborative whiteboard, wikis, and more. In this course, the instructor wants students to design an asynchronous mathematics activity as preservice mathematics teachers by coding through GeoGebra. From the observation notes, the students work in groups of three or four and each group prepared an asynchronous mathematics activity that students can do by themselves at their own time. For example, one of the groups created a triangle game, in this game the main purpose was to examine the triangulation state of the given lengths. There were hints, score, and guess check parts in the game. The students create this game by coding through GeoGebra. In fact, this coding process was the most asked part of WhatsApp. In GeoGebra, three codes emerged from the interview data such that complicated, technological, and professional development. Three students explained their GeoGebra experiences by referring to the tools' complex and difficult-to-understand features. However, these students also indicated that this tool provided insights into technology and this tool contributed to their professional development as a preservice mathematics teacher. For example, one student indicated that *"I even used GeoGebra in my lectures at the school where I did my internship with what I learned in this course and showed it to my students"* (Participant 1).

The codes of Perusall emerged as the monitored environment, with pleasant and uninteresting content. All the participants defined Perusall environment by emphasizing the instructor's role in this environment. They explained that the instructor as surveillance, she/he did not make any comments or sharing on this social reading platform but always followed students' actions. For example, one participant indicated

that *"My teacher there can clearly see something I did online in Perusall in other words, she/he was observing what we did, what we wrote, and so on"* (Participant 3). In addition to that, all participants highlighted that Perusall made reading activity pleasant with the tool features such as highlighting, commenting, and seeing others' activities. These participants also indicated that Perusall could have been used more in the course. There were the readings only at the beginning of the course and Perusall was only used for these readings. In the observation notes, there were already requests from the students to the instructor about the more use of this tool. Conversely, one student stated that she/he found the content boring and therefore did not use the application actively. Overall, Perusall used to manage and monitor the interaction of students. There is also one more tool for management.

Feature's theme included three codes such as not active use, organized, and late reply in Moodle which is a learning management system. All participants indicated that Moodle did not use actively in the course, and they suggested that it should be used more. For example, one student said that *"Moodle was not used. It was a very helpful and sufficient platform for other courses, namely asynchronous or synchronous courses. It would be good for this course as well, the supports I mentioned could be easy to transfer from there"* (Participant 2). These participants attributed the low use of Moodle to the effective use of WhatsApp. In addition to that one participant indicated that when they asked a question from Moodle, received a late reply, so they turned to WhatsApp more. On the other hand, two participants highlighted that Moodle offers an organized environment for asynchronous learning. Moreover, this participant said that this organized environment is also important for future use. For example, one student said that *"The Moodle environment is a slightly more stable environment, where we can access certain parts of the answer to your question directly, and it is more organized. And it can provide an archive attribute."* For WhatsApp, a student said that *"The shared ones are overlooked, and I can't find them"* (Participant 4). Therefore, Moodle was needed and used for document sharing and assessment. WhatsApp was used for some features that they could not access or obtain with Moodle. Also, Moodle was used for some features that they could not access or obtain with WhatsApp.

Overall, the tools interacted with the students' learning Experiences with their different features that are unique to the tool itself in a common theme. The reason behind the students' highlighting the tools' features might be related to the course content because this was a learning technology course. The course already had a close relationship with technological tools. Therefore, in addition to the features of the tools, the learning experiences with the tools are examined in the next section to deeply explore the tools' interaction.

7.2.2. Learning Experiences

The second common theme of the interaction with the tools category emerged as learning experiences. The learning experience's theme included codes in which students explained the interactions during the asynchronous learning environment through technological tools. This theme is included 6 codes from different tools. These codes and technological tools are represented in Table 7.2.

Table 7.2. Learning experiences.

Codes	**Tools**
Interaction with the Instructor Interaction with peers	WhatsApp
Learning from instructor's examples	GeoGebra
Collaboration	Perusall
Learning Management	Moodle
Asking question	Mail

Interestingly, each code is only released for a specific tool. In other words, the tools are differentiated in terms of their use in the learning experience. For example, the instructor targeted both interaction and management for Moodle, but then only management remained because of the student's needs. Therefore, findings for this theme are discussed according to the technological tools.

In the WhatsApp tool, there are two codes: interaction with the instructor and interaction with peers. Three of the four participants stated that interacting with the instructor such as asking questions, taking quick feedback, and getting help through WhatsApp affected their learning process. For example, one student indicated that *"Our teacher helped us a lot in WhatsApp groups, and we were able to get very fast feedback. When we asked a question, she/he sometimes made us discover it, sometimes he made it to us when we had a technical error and gave it back to us"* (Participant 2). In addition to that all participants indicated that interacting with their peers through the WhatsApp has *"a big effect"* (Participant 5) in their learning process. Participants explained their way of interaction such as collaboration, asking questions, answering, and giving feedback. For example, one student said that *"There was an experience in the WhatsApp group where we became more interactive with each other and were able to answer each other's questions"* (Participant 4). Moreover, two students indicated that the instructor encouraged students to interact with each other through the WhatsApp group such as *"When we wrote something to the WhatsApp group, that is something she/he wanted all our friends to look at"* (Participant 4). The researcher was in the WhatsApp group as an observer. The observation notes supported that there is a strong interaction with the instructor and among the participants especially at the end of the semester when the students work on final projects. It was surprising that although WhatsApp is a communication tool, it emerged as a learning tool here. Even the emergence of it as a learning tool was something the instructor did not plan. The instructor adapted WhatsApp, for students' choice through the course. Toward the end of the semester, WhatsApp was opened while the students were working on the final project given in GeoGebra. During this time, the students felt the need to communicate quickly and instantly because they had questions and needed quick feedback. WhatsApp was activated to meet this need of students. In the interview with instructor, she/he indicated that *"WhatsApp Actually, it wasn't something I designed at first, I didn't think I would do much, but I was also aware that Moodle might not work well, or questions might not come from there. As a matter of fact, it happened. That's why I opened WhatsApp by sacrificing a little of my own time or expanding my personal boundaries."* One of the questions asked to participants was whether they

are a learning community or not in the asynchronous environment. All participants indicated that their interaction with their peers enabled being a community in the WhatsApp group. For example, a student indicated that *"In the WhatsApp group, we become more interactive with each other, and we can answer each other's questions, and we have created a community in this respect"* (Participant 4). Being a community through WhatsApp is also seen when students work on GeoGebra.

In the GeoGebra tool, there is one code in the learning theme: learning from instructors' examples. Three of the four students indicated that they experienced GeoGebra by observing the instructor's GeoGebra profile and her/his YouTube channel which she/he shared GeoGebra project examples. For example, one student indicated that *"It helped us to have the teacher's own page here and how the teacher progressed one by one. Also, on YouTube she/he explained how he did it"* (Participant 5). Students also indicated that they also get help from WhatsApp when working on GeoGebra. In other words, when students have technical or content-related questions about GeoGebra, they asked their questions and discussed them through the WhatsApp group. For example, one student indicated that *"We had a hard time writing code in GeoGebra. So, it was good to be in the group so that we can better learn what to do during the code-writing phase. This group was not planned either, in fact, it was created out of necessity"* (Participant 2). The observation notes from the WhatsApp group also suggested that this group is actively used when students work on GeoGebra. This is because GeoGebra doesn't have a social component for interaction. This lack of social interaction could have been met in the classroom environment, in fact, the observation notes show that GeoGebra was carried into the classroom environment, but they were able to establish this interaction with WhatsApp on the asynchronous side. If there was not such an interaction medium on the asynchronous side, they would have difficulties.

In Perusall, collaboration code emerged as a learning theme. All the participants indicated that they learned from each other by discussing, giving feedback, and reading and enriching comments through this social reading tool. For example, one

student indicated that *"There was an environment in perusal where we guided each other in the form of comments and feedback, we received help and enriched each other"* (Participant 5). In addition, participants said that seeing the majority's highlights and comments on reading material affected their learning experience. For example, *"I have enjoyed reading all the readings. I think the reason is the discussion part there, we could underline it, then we knew who said what where and which part was more important. In some readings, for example, where most of my friends focused, I can say that I was looking at those parts more"* (Participant 2). The researcher was an observer participant in the Perusall. The observation notes also suggested that there was 103 average number of comments and 50.3 average time spent on each reading. In addition to students' collaboration within the Perusall tool, two of the four participants indicated that the instructor carried comments, highlights, and discussions of Perusall to face-to-face classes. Participants indicated that carrying this environment to the face-to-face class also supported face-to-face collaboration. The researcher also supported by face-to-face observation notes that there were some classes in which the instructor opens the Perusall in the class and maintain this environment in the face-to-face sessions. Also, the instructor explained in both pre and post-interview this was a planned and organized activity.

In Moodle, participants indicated that learning management system features such as forums and sharing resources affected their learning process. However, all the participants indicated that the use of Moodle throughout the lesson was not preferred. For example, one student indicated that *"Our teacher opened the discussion section in Moodle. If anyone had difficulties in GeoGebra and other activities, he asked them to write there. Both to help each other, but I did not participate in this environment much, unfortunately, I could not see it at all. So, I thought it was overlooked. I think it was such a big oversight. I think the WhatsApp group got into such a phase when it was overlooked"* (Participant 2). Actually, the instructor designed Moodle for organization and interaction throughout the course. However, the interaction side is not preferred by the students. In the interview, the instructor said that *"In Moodle, there was a design of parts that I wanted students to share if they had questions. but we can't see*

the function there, the question never came from there. Since the perspective of entering the Moodle environment and writing my question is not very intense. That's why I opened WhatsApp, and as a matter of fact, more questions came in WhatsApp." Social interaction is important for asynchronous environments and the instructor is aware of this, so she/he turned up WhatsApp during the semester. For example, she/he said that *"I added the WhatsApp section to activate students' asking questions and discussions."* This was a student-centered change because students preferred WhatsApp instead of Moodle.

In the e-mail, asking question code emerged from the interview data in the learning theme. Two of the participants indicated that asking direct questions to the instructor through mail affected their learning process. These questions and answers were mostly direct questions such as *"I have received direct answers to the questions I have asked via e-mail and have started the practice according to the answer I have received"* (Participant 4). However, asking questions through e-mail was not a much-preferred option by the students and the instructor. The instructor explains that *"There are e-mails that students send to me individually, and I reply to them, but it is not something I prefer. Another purpose of especially opening WhatsApp was that they send a common place so that I can reply to a commonplace and this answer can be the answer of others."*

7.3. Components of CoI

The last category that emerged from students' interviews was Components of CoI. In this section, the components of the Community of Inquiry (CoI) framework as Social Presence, Cognitive Presence, and Teaching Presence in the asynchronous part of the course are presented using survey data and interview data with secondary data to support findings.

The participants for the interview were selected according to survey results. In the interview main question asked to students was how they experienced the asynchronous

components of the course. In addition to that the questions asked to students such as how they experienced design and organization in the asynchronous components, how they experienced the facilitator role of the instructor in the asynchronous components, and how they experienced direct teaching in the asynchronous components. Although the main questions were related to the teaching presence construct of the community of inquiry framework, other presences such as social and cognitive also emerged from the data. It was not surprising because the teaching presence is defined by as the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes (Garrison et al., 2002). In other words, the social and cognitive presences are interrelated with the teaching presence. Therefore, all components of CoI were examined to understand how the teaching presence was experienced in the asynchronous part of the course.

7.3.1. Social Presence

According to survey results, among the presences of CoI the lowest presence was social presence (Mean=3.91). There are 9 survey items in the social presence category, 38% of students marked 5 points and 23.5% of students marked 4 points and 30.3% of students marked 3 points. The lowest experiences in the social presence category are the items "Online or web-based communication is an excellent medium for social interaction" and "Online discussions help me to develop a sense of collaboration." The social presence items and median, mean, and standard deviation scores for each item are presented in Table 7.3.

Table 7.3. Social presence survey findings.

Categories	**Items**	**Median**	**Mean**	**SD**
Affective Expression	Getting to know other course participants gave me a sense of belonging in the course.	4	4.04	1
	I was able to form distinct impressions of some course participants.	4	3.85	0.97
	Online or web-based communication is an excellent medium for social interaction.	4	3.73	1.08
Open Communication	I felt comfortable conversing through the online medium.	4	4	1.06
	I felt comfortable participating in the course discussions.	4	4	1
	I felt comfortable interacting with other course participants.	4	4.1	1
Group Cohesion	I felt comfortable disagreeing with other course participants while still maintaining a sense of trust.	3	3.8	1.1
	I felt that my point of view was acknowledged by other course participants.	4	3.92	0.89
	Online discussions help me to develop a sense of collaboration.	4	3.73	1.19

In the students' interview transcripts, although the main questions were not about social presence, there were emerged codes for social presence. The deductive coding process is conducted by matching open codes and indicators of the CoI framework. Suggested data from secondary data sources such as Moodle, Perusall, WhatsApp, and the instructor's interview were also used in addition to interviews to show examples for indicators. The open codes are coded for affective expression, open communication, and group cohesion which are categories of social presence. In the affective responses category, the indicators are expressing emotions, use of humor, and self-disclosure. In the WhatsApp observation notes, it was seen that students and the instructor expressed their emotions using emojis such as grinning faces, smiling faces with tears, etc. Moreover, there were some messages that can be an example of using humor. For example, the instructor said to a student *"How many days have you been absent from the market, Mr. Emre? :)"* and the student answered that *"Sir, unfortunately the market left me"* (A Turkish joke, WhatsApp). There are also examples of self-disclosure. In the students interview one student indicated that *"When I put myself in the position of a teacher, for example, when I give lectures during internship. . . ."* (Participant 1). In the open communication category, the indicators are continuing a thread, quoting from others' messages, referring explicitly to others' messages, asking questions, complimenting/expressing appreciation, and expressing agreement/ disagreement. As an example, to continuing a thread and referring indicators, in the interview, one student indicated that *"Sometimes this was in the form of an answer, to a friend's comment or as an addition"* (Participant 5). In addition to that referring explicitly to others' messages was in the Perusall because this tool has the feature of tagging someone to sharing, students were tagging classmates to their postings. The observation notes suggested that students used quotations when messaging through WhatsApp. Moreover, as an example of asking question indicator, a student indicated that *"We constantly asked each other questions during the day on WhatsApp"* (Participant 1). For complimenting/expressing appreciation indicator, it was observed in WhatsApp that students expressed appreciation by saying such as *"you are right"* and *"good idea."* As the last indicator, expressing agreement/disagreement was observed mostly on Perusall. There are total of 27 comments that include agreement or disagreement. In the group cohe-

sion category, there are three indicators such as vocatives, addresses or refers to the group using inclusive pronouns, and phatics/salutations. The examples for vocatives are mostly seen in the WhatsApp group because students mostly called each other by their names. In addition to that one student indicated that *"There was a flow where we enriched each other by saying that I agree with Begüm's comment and even I think"* (Participant 4). Addressing the group indicator was pointed out by the student's interview such as *"We have become more interactive with each other in the WhatsApp group, in this respect, we have created a community there"* (Participant 4). In the last indicator of group cohesion is phatics/salutations, observation notes suggested that students used words such as *"hi everyone"* and *"thank you."*

Overall, the social presence indicators emerged from the students' interviews and were suggested by secondary data sources. There is social presence, but the remarkable thing here is that it actually comes out of only 2 tools: Perusall and WhatsApp. Perusall is also expected because it is a social reading environment used for this purpose, but it has limitations. It is important that although Perusall was used at the beginning of the lesson, the participants remembered and expressed it in the interview. For WhatsApp, as it was discussed above, the teacher felt the need and opened it, the findings here also support this. If WhatsApp was not used, it means we would see social presence in a more limited way, only in Perusall. In other words, WhatsApp was used not only for announcements but also for social presence, that is, to regulate and support learning. As a result, WhatsApp, a communication platform, has turned into a tool that plays a role in learning here.

7.3.2. Cognitive Presence

According to survey results, students experienced high cognitive presence. There are 12 survey items in the cognitive presence category and 48.7% of students marked 5 points and 35.3% of students marked 4 points. All items' mean values are greater than or equal to 4 points. The cognitive presence items and median, mean and standard deviation scores for each item were presented in Table 7.4.

Table 7.4. Cognitive presence survey findings.

Categories	**Items**	**Median**	**Mean**	**SD**
Triggering Event	Problems posed increased my interest in course issues.	4	4.3	0.7
	Course activities piqued my curiosity.	5	4.4	0.8
	I felt motivated to explore content related questions.	5	4.5	0.71
Exploration	I utilized a variety of information sources to explore problems posed in this course.	4	4.31	0.68
	Brainstorming and finding relevant information helped me resolve content related questions.	5	4.58	0.76
	Online discussions were valuable in helping me appreciate different perspectives.	4	4.08	0.89

Table 7.4. Cognitive presence survey findings. (cont.)

Categories	**Items**	**Median**	**Mean**	**SD**
Integration	Combining new information helped me answer questions raised in course activities.	4	4.38	0.75
	Learning activities helped me construct explanations/solutions.	5	4.6	0.6
	Reflection on course content and discussions helped me understand fundamental concepts in this class.	5	4.31	0.79
Resolution	I can describe ways to test and apply the knowledge created in this course.	4	4.1	0.8
	I have developed solutions to course problems that can be applied in practice.	4	4	1
	I can apply the knowledge created in this course to my work or other non-class related activities.	4	4.2	0.8

In the students' interview transcripts, there were emerged open codes for cognitive presence. Although the main questions were not about cognitive presence, there were open codes for cognitive presence. The deductive coding process is conducted by matching open codes and indicators of the CoI framework. Suggested data from secondary data sources such as Moodle, Perusall, WhatsApp, GeoGebra, and the instructor's interview were also used in addition to interviews to show examples for indicators. Cognitive presence was coded for triggering events, exploration, integration, and res-

olution. In the triggering event category, there are two indicators such as recognizing the problem and a sense of puzzlement. These indicators emerged in the interview and supporting data. In the interview, all students highlighted that they become curious and wanted to learn with the questions of the instructor. Also, observation notes suggested that these were triggering questions such as *"This is a challenging question but try to describe what 'for you' technology is about"* (Moodle). In the exploration category, there are five indicators: divergence, information exchange, suggestions for considerations, brainstorming, and leaps to conclusions. For divergence, there were examples on Perusall where students leave comments on readings about their opposite or different views such that *"Although transference is valuable in many areas, it cannot be an adequate form of teaching and self-expression in a profession."* In addition to that when students explain their experiences on GeoGebra they stated that *"In fact, we need to think a little more broadly"* (Participant 5) as an example of divergence. For the information exchange indicator, there were examples on the interview transcripts such as *"sometimes the teacher made us discover"* (Participant 3). In addition to that one of the students referred brainstorming indicator by indicating *"We exchanged ideas with each other a lot"* (Participant 3). There were also examples of suggestions for considerations indicator. For example, three students highlighted in the interviews that they give peer feedback on each other's works. The last indicator of exploration which is leaps to conclusions mostly seen in the observation notes of Perusall. There are some examples on Perusall such as *"In this reading article, the objective and purpose of the mathematics we will teach our students."* In the integration category there are three indicators such as convergence, synthesis, and creating solutions. The students explained their experiences when they work on a project, and their experiences included examples for indicators of integration. For example, they stated, *"We had to deduce by focusing"* (Participant 4) for convergence, *"Looking at each other, we connected ideas"* (Participant 1) for synthesis, and *"There was a flow that we had to plan and finally create something"* (Participant 5). The last category is resolution, and the indicators apply test and defend. This category indicators mostly emerged in WhatsApp observation notes. When students work on their GeoGebra projects, they communicate through WhatsApp. For example, one group was working

on creating a geometry game through GeoGebra. Firstly, they write codes, then they tested these codes to understand whether work or not. Then the code works, and they shared the game the through WhatsApp group. This process included all indicators of the resolution category.

Overall, the cognitive presence indicators emerged from the students' interviews and were suggested by secondary data sources. It is important that the examples of cognitive presence indicators are mostly related to students' control and management of their learning process. In other words, students developed their learning agency in the asynchronous part of the course. Moreover, when students took responsibility for their learning, they were supported by the instructor and the learning community.

7.3.3. Teaching Presence

According to survey results, overall, the student experienced all teaching presence survey items high. There are 13 survey items in the teaching presence category and 69.5% of students marked 5 points and 21.6% of students marked 4 points. Among the categories of teaching presence, the highest category is design and organization with 4.7 mean score. The mean score of the facilitation category is 4.65. The lowest category is direct instruction with 4.39 mean score. The lowest experience in the direct instruction category was the item "The instructor provided feedback in a timely fashion." This item has 4.19 mean, 4 median, and 0.9 standard deviation. In the face-to-face lessons observations, the researcher observed that instructors generally give verbal feedback about asynchronous activities. For example, in the one of lessons in the computer lab, the instructor wants from students to open their GeoGebra activities which is a part of the asynchronous component. Then students start to work on their projects with their groups and the instructor go to each group and give feedback and students asked their questions. At the end of the course, the researcher asked the instructor about the lesson and GeoGebra activity. The instructor said that she/he gave feedback and answered students' questions through email about the asynchronous GeoGebra activity, but these are not systematic. Then she/he decided to mention this asynchronous activity in a

face-to-face class. Therefore, the lack of written feedback may cause the lowest mean score of the item "The instructor provided feedback in a timely fashion."

Table 7.5. Teaching presence survey findings.

Categories	**Items**	**Median**	**Mean**	**SD**
Design & Organization	The instructor clearly communicated important course topics.	4.73	5	0.53
	The instructor clearly communicated important course goals.	4.69	5	0.62
	The instructor provided clear instructions on how to participate in course learning activities.	4.69	5	0.62
	The instructor clearly communicated important due dates/time frames for learning activities.	4.7	5	0.5
		4.7		
Facilitation	The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn.	4.7	5	0.7
	The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking.	4.7	5	0.5

Table 7.5. Teaching presence survey findings. (cont.)

Categories	**Items**	**Median**	**Mean**	**SD**
Facilitation	The instructor helped to keep course participants engaged and participating in productive dialogue.	4.62	5	0.7
Facilitation	The instructor helped keep the course participants on the task in a way that helped me to learn.	4.7	5	0.5
	The instructor encouraged course participants to explore new concepts in this course.	4.7	5	0.5
	Instructor actions reinforced the development of a sense of community among course participants.	4.5	5	0.7
		4.65		
Direct Instruction	The instructor helped to focus the discussion on relevant issues in a way that helped me to learn.	4.62	5	0.64
	The instructor provided feedback that helped me understand my strengths and weaknesses relative to the course's goals and objectives.	4.35	5	0.85
	The instructor provided feedback in a timely fashion.	4.19	4	0.9
		4.39		

In the interview, the main question asked students was how they experienced the asynchronous components of the course. In addition to that the questions asked to students such as how they experienced design and organization in the asynchronous components, how they experienced the facilitator role of the instructor in the asynchronous components, and how they experienced direct teaching in the asynchronous components. The main question and additional questions asked students to understand how they experienced the teaching presence construct of the CoI framework during the course. Open coding process applied to interview transcripts to be able to explore students' experiences on teaching presence. The inductive data coding process was conducted using emerged codes. The codes that emerged were parallel with the CoI framework's teaching presence codes. Teaching presence categories are design and organization, facilitating discourse, and direct instruction.

7.3.3.1. Design and Organization. In the design and organization category, there are five indicators: setting curriculum, designing methods, establishing time parameters, utilizing medium effectively, and establishing netiquette. For the setting curriculum indicator, all the participants addressed that at the beginning of the course, there was a clear syllabus about the course topics and course goals, and they clearly introduced to them. The observation notes also suggested that the syllabus was shared with students through Moodle and explained at the first face-to-face class. For example, one student indicated that *"syllabus already existed, but in fact, we understood it more clearly as the time of our homework approached. But it is clear from the beginning, in general terms"* (Participant 5). There were also observation notes from Moodle and Mail when the instructor introduces a course topic for a week. In addition, participants pointed out that they clearly informed about the main course goals. They explained that learner-centered teaching methods are used in the course and the main goal of the course was learning technology by exploration. For example, one student indicated that *"the important thing was to discover and learn for us as well as for our teacher"* (Participant 2). The observation notes also suggested that the instructor was clear to explain the main course goal. However, one student indicated that although the design and organization of the course were good and clear when they work on a specific task,

there were problems with clear goals. That student indicated that *"the organization was good, but even if it was explained at first, it was not clear what task aimed for in my mind. so, I am doing something but what is the aim? What exactly is requested? I was not aware of this. In some places, I also had a hard time completing the process because of this"* (Participant 4). Surprisingly, this student related what she/he was talking about with the main purpose of this lesson. Then she/he said, *"but again, I think this is related to the fact that the main achievement of the course is related to experience and discovery. because when I came up with something at the end of the process, I said "aaa", that's it. and I realized that this is the part where I understand the main purpose"* (Participant 4). Therefore, students experienced the design of the organization category of teaching presence by indicating to them clearly how the course would be handled in terms of course topics and goals.

On the other hand, for the designing methods indicator, three students indicated that this syllabus was not contain details, and the learning activities and methods were not clear at the beginning. For example, one student indicated that *"I had no idea how to do it"* (Participant 5). They indicated that the details of participating in the activities become clear with time, sometimes the instructor explained after the activity started and sometimes, they become clear by asking questions to the instructor. For example, in the GeoGebra activity, students explained that they were not clear about how they do. When the students started to work on this activity, the instructor introduced details in a face-to-face class, and in the asynchronous components, she/he presented example works on Moodle and shared additional explanations when students need through WhatsApp. Then the students explained that they become clear about the activities such as *"It cannot be said that the activities were completed easily. But it becomes easier by interacting with the instructor on WhatsApp or Mail"* (Participant 2). In addition to that face-to-face component of the blended course helped students to become clear on how to participate in learning experiences because the instructor provided instructions in some face-to-face classes. For example, one student indicated that *"The teacher showed us how to participate in GeoGebra, both by visiting the class one-on-one and by sharing the example from her/his own screen"* (Participant 3).

For establishing time parameters indicators, students explained that they clearly informed about important due days. Observation notes also suggested that these important due dates were introduced and reminded students through Moodle, Mail, and WhatsApp. In addition to that, the instructor's effort to regulate learning was also reflected in this. For example, the instructor opened a poll on WhatsApp at the request of the students and asked the following question *"postpone deadline to tomorrow night."* For utilizing medium effectively indicator, there were examples from students' interviews and secondary data sources. For example, one participant addressed that the instructor suggested them to use Perusall. Moreover, one participant indicated that *"My instructor there can clearly see something I did online in Perusall"* (Participant 1). Observation notes also suggested that the instructor was using features of Perusall that show students' actions such as reading rate, number of postings, number of questions, and average time spent. The teacher was intervening in the process by looking at these data. In addition to that, other tools' features such as forums on Moodle, a poll on WhatsApp, and coding on GeoGebra were also examples of utilizing medium effectively indicator. For establishing the netiquette indicator, all participants addressed that they knew how to behave and what to do in an asynchronous environment. The observation notes also suggested that there are examples of instructor postings to establish netiquette such as *"Try to be brief, to the point and . . . . . "* (Moodle). The general comments of students for design and organization were such that *"organization was good"* (Participant 3), *"Everything was balanced and clear at the end"* (Participant 2), and *"There was a well-planned learning environment"* (Participant 5).

Overall, for the design and organization of the asynchronous task, the instructor settled the curriculum at begging in general and then shaped it through the course. It is important that the instructor intentionally has course planning and design in advance. This course is not a clear-cut content course for students. The nature of the course is some degree methods course and it's about how to teach mathematics with technology. It is also designed with asynchronous components. Because of this, the teacher designed the lesson in this way. These indicators of design and organization show how students experience this design, which is complex and general at first but becomes clear later.

When it became clear, it is important that face-to-face and asynchronous components are used together and complementary to each other. There was a balance between asynchronous and face-to-face components. In addition to that the instructor's use of more than one tool to establish time parameters is also important because it means that she/he felt the need for more than one tool in the asynchronous environment. Finally, the instructor's effort to regulate learning was an important finding to understand her/his design approach for students who have low self-regulation.

7.3.3.2. Facilitating Discourse. In the facilitation discourse category, there are six indicators: Identifying areas of agreement/disagreement, seeking to reach consensus, encouraging/acknowledging, or reinforcing student contributions, setting a climate for learning, drawing in participants/ prompting discussion, and assessing the efficacy of the process. In the interview, all students highlighted that *"the instructor help us..."* but the students' examples were different and there was various type of help. For identifying areas of agreement and disagreement indicator, one student indicated that *"Our teacher helped us a lot in WhatsApp groups when one of us shared something, she/he asked if we agreed and made us discover it"* (Participant 3). The observation notes also suggested that there were examples in WhatsApp in which the instructor was asking *"Do you agree with this?"* For seeking to reach a consensus indicator, all students addressed that the instructor was questioning their own ideas and other groups' works. She/he was wanting them to reach an idea by asking *"How can you convert this"* (Participant 3). Students explained that the instructor helped them to clarify their thinking in this way. Also, students indicated that this process improved them. One student addressed that *"In questions, our teacher was responding with questions again"* (Participant 2). Moreover, there were examples of seeking to reach consensus indicators in the face-to-face classes according to observation notes. For example, in one of the classes the instructor opened Perusall sharing on the board and wanted students to discuss each other's comments, and at the end the class reach some conclusions.

For encouraging/acknowledging, or reinforcing student contributions indicator, there were highlights in the interviews and the suggested data. For example, one student indicated that *"the teacher was always pushing us for our discussion"* (Participant 1). The instructor sometimes directly said students about they should discuss. Also, the instructor was encouraging students to use discussion tools such as Perusall. The observation notes and the instructor interview suggested that the instructor was giving participation points for their Perusall use to encourage them to use more. In addition to that, there were also other encouragement examples in the student interview. For example, one student indicated that *"the GeoGebra examples of the teacher were very interesting, it was one of the parts that interested me, and I wanted to do projects like them"* (Participant 1). The instructor encouraged this student by attracting their attention. In addition, there are reinforcement examples when students contribute such as *"thank you..."* (WhatsApp). For drawing in participants/ prompting discussion indicator, two students addressed that the instructor prompted students to discuss and learn. For example, one student pointed out that *"The teacher was asking if there were different solutions, and we were helping each other"* (Participant 5). Observation notes suggested that the instructor prompted some students who send a few messages in WhatsApp to discuss more by saying such as *"It makes me happy to support each other :D"* (WhatsApp) or *"C'mon, everyone who sees this question finds an answer to this question"* (WhatsApp).

For setting the climate for learning indicator, all participants addressed that the asynchronous learning environment was comfortable and efficient. For example, one student addressed that *"I have never felt nervous and stressed, really, I think it gave me that comfort and flexibility"* (Participant 3). Another participant pointed out that *"It was the class I felt most comfortable in"* (Participant 1). In addition, participants highlighted the instructor's characteristic features when indicating the climate of the learning environment such that *"the teacher's approach made this course a really comfortable course, it made me feel very good"* (Participant 1). Two students addressed that they were affected by the instructor's helpful, respectful, and kind characteristics as well as her/his teaching skills.

For assessing the efficacy of the process indicator, all students addressed that the instructor was continually monitoring and controlling their process. They point out that the instructor was seen online even though she/he didn't write anything and looked for students' processes. On the other hand, one student stated that there was a need for more facilitation in the asynchronous environment. She/he explained that the instructor's facilitation was mostly in the face-to-face classes and in the asynchronous environment there was a lack of facilitation.

Overall, it is important that face-to-face and asynchronous components are used together and complementary to each other in the facilitating discourse category. There was a balance between asynchronous and face-to-face components. In addition, students felt good and involved in the asynchronous learning environment. This climate of the learning environment is mostly associated with the instructor's characteristics and role in the asynchronous environment. Moreover, encouragement was important as students will learn not only to use technology but also to design activities and teach mathematics with it. Therefore, the instructor maintained encouragement in the asynchronous learning environment. This was a teacher education course, so the instructor encourages pre-service teachers to improve their teaching skills through course activities.

7.3.3.3. Direct Instruction. In the direct instruction category, there are seven indicators: Present content/questions, focus the discussion on specific issues, summarize the discussion, confirm understanding through assessment and explanatory feedback, diagnose misconceptions, inject knowledge from diverse sources, and respond to technical problems. Among the categories of teaching presence, the direct instruction category was the most emerged category. The researcher asked to participants whether they experienced direct teaching or intervention in the asynchronous components of the course and how. All participants addressed that they experienced direct intervention and there were different examples of indicators. For the present content indicator, one student addressed that the reading materials on Perusall were an example to direct teaching. The student said that *"yes, in Perusall, since direct readings themselves*

are content for the study or achievement we intend, maybe we can put this into direct teaching" (Participant 4). For focusing the discussions on specific issues and summarizing discussion indicator, after the instructor was presenting the reading material to students on Perusall, then the students' comments, highlights, and discussions was opened in some face-to-face classes. In those cases, the direct instruction that started by presenting material in the asynchronous environment was continued in the face-to-face classes of the blended course with a focus on the discussion on specific issues and summarizing the discussion indicators. The instructor explained this process such that *"Actually, asynchronously preparing the readings in perusal is exactly the direct instruction. The part where I move the asynchronous ones to the face-to-face part, for example summarizing their discussions and underlining the important points, is also direct instruction."* In the observation note from WhatsApp there were also examples of summarizing and focusing discussions.

For injecting knowledge from diverse sources indicator students explained that the instructor was presenting additional sources to improve their skills and knowledge. All participants indicated that extra sources shared by the instructor such as YouTube channel were helpful for them. For example, one participant indicated that *"We did a lot of things by looking at the YouTube channel as well"* (Participant 2). There were also additional source links in Moodle. In addition to that the instructor also shared personal experiences with students. All participants pointed out that the instructor's own GeoGebra account and examples were very helpful resources for them. For example, one student indicated that *"It was very helpful for us that the teacher shared her/his profile with us at GeoGebra and that there were examples she/he made there"* (Participant 5). In addition, one student indicated that *"When you are away, the knowledge is not only in the teacher"* (Participant 1).

For responding to the technical problems indicator, three students highlighted that they experienced direct intervention mostly when they ask questions about technical problems. They indicated that *"When there was a problem in the tools section, I was able to get a direct answer to the questions"* (Participant 1).

To confirm understanding through assessment and explanatory feedback indicator, one student addressed that *"The teacher was evaluating our projects with rubrics and giving written feedback accordingly" (Participant 4).*

For the diagnosis misconceptions indicator, one participant pointed out that when they are in the wrong way, the instructor was interfering with them. For example, the student addressed that *"I did this but questioning whether I'm on the right step or maybe I've done wrong, but the instructor made this lesson a relaxing lesson for me"* (Participant 1). In addition, there were observation notes as an example of this indicator such as *"Your problem here is that you don't..."* (WhatsApp). On the other hand, one student indicated their need for direct instruction from the course instructor.

Overall, the instructor used a direct instruction strategy to meet the pre-service teachers learning needs. The students were pleasant with direct teaching, it made the process easier for them. Also, they needed more direct instruction because of their lack of self-regulation.

8. DISCUSSION

8.1. Pre-Service Teacher Education

The course which was the focus of this research was a blended pre-service teacher education course. Blended learning is defined as a combination of learning delivery methods (So and Brush, 2008). There is a lack of consensus on what instructional designs regarded as blended learning might be and there are a variety of mixes in blended learning environments (Garrison and Kanuka, 2004; Osguthorpe and Graham, 2003). In fact, Garrison and Kanuka (2004) said that "no two blended learning designs are identical." The course is designed with face-to-face and asynchronous components. The blended course model is an important innovative approach to embrace the advantages of both face-to-face and asynchronous learning and to overcome the limitations of both approaches (Keengwe and Kang, 2013). Moreover, blended learning provides an opportunity to integrate innovation and the benefits of technology in online learning with the interaction and participation of the benefits of face-to-face learning (Bokolo et al., 2020). In the course of this research the instructor designed face-to-face and asynchronous components. For the instructor's purpose of teacher education, the face-to-face and asynchronous components are designed with a unique design for each approach. In other words, the design and implementation of activities in asynchronous components were specific for this learning environment of pre-service teachers. Even though the course has multifaceted for this research the focus was how asynchronous components are experienced in terms of teaching presence. Lowenthal et al. (2020) conducted a study with pre-service teachers during Covid-19 and found asynchronous teacher education helped students actively participate in course activities and develop self-management in their own learning process. In the course, there was also interaction between face-to-face and asynchronous components. The instructor intentionally carried some part of asynchronous learning activities to face-to-face classes, that was the part of course design. There was a balance between the components of the blended course. The instructor used the advantages of both approaches by designing

them coherently with paying attention to the challenges of both. The participants were also pleasant with this balance, and this process improved their learning achievements. Moreover, they also evaluated their blended learning process as enjoyable and as a good sample lesson for a blended course. These findings were parallel with the existing literature, studies confirmed that blended learning has a positive impact on attaining course outcomes for pre-service teachers (Aksu and Atmacasoy, 2018). Moreover, blended learning environments contribute to the development of positive attitudes of teacher candidates toward lessons (Aksu and Atmacasoy, 2018).

For teacher education, the blended learning and teaching approach is a relatively new field of practice and study (Keengwe and Kang, 2013). This trend toward blended forms of teacher education has accelerated in the context of Covid-19 and led providers to review their processes (La Velle et al., 2020). Also, the literature suggested that blended teaching and learning implementations are an increase in the faculties of education in Turkiye (Aksu and Atmacasoy, 2018). After Covid-19 there were new and innovative approaches to teacher education (Scull et al., 2020). Indeed, this research started by wondering how the asynchronous side of a post-pandemic blended lesson was. For this purpose, I looked for a course that will implement asynchronous teaching in Fall-2023 academic semester. This course was an applied laboratory course. The main purpose was to improve preservice teachers' competencies in teaching mathematics with technology. In addition to learning technological tools, the instructor aimed for students to use these technologies for creating tasks and to integrate these technologies into their lesson plans. Moreover, she/he wanted for teacher candidates to gain a perspective and position for technology use. In the asynchronous components, for these purposes, students read, annotated, and discussed materials of technology use, explored technological tools, and developed tasks with these technological tools. They worked collaboratively in the asynchronous environment through this process. Asynchronous components are designed for students to discover the content and manage their own learning process with the guidance and control of the instructor. For these purposes, the course practices were implemented.

8.2. Blended Teacher Education Course Implementation

In this section, the course implementations are discussed in relation to the teaching presence of CoI and social and cognitive presence since they have close relation with teaching presence. The implementations included asynchronous components and some face-to-face components which had an interaction with asynchronous components. The course has several asynchronous practices with different tools. Therefore, the implementations are discussed under the practices in the next sections.

8.2.1. Collaborative Annotation Implementation and Teaching Presence

The first practice of the asynchronous learning environment was a collaborative annotation (CA) activity through Perusall. The instructor uploaded materials to provide students theoretical background of technology use in teaching mathematics. For this purpose, the instructor used a collaborative annotation tool to increase students' reading rates and to be able to construct a learning community. Interview findings suggested that students feel in a learning community when read and discuss through Perusall and they read more. The instructor was also aware of the importance of creating a learning community in asynchronous learning environments for effective teacher education. In parallel with the instructor's view, there are many studies that present convincing arguments that the community is necessary for distance learning in higher education because it reduces feelings of loneliness, increases students' academic and social success, improves curriculum integration, and increases learning-related satisfaction (Calderwood, 2000; Rovai, 2002; Tyron and Bishop, 2009). With this importance and the increased number of distance education implementations, educators are increasingly looking for new ways to build community in asynchronous learning environments (Allen and Seaman, 2014). In this course, interview findings suggested that students built a learning community through Perusall. Moreover, the collaboration feature was the most unique highlighted feature of Perusall. The course participants work collaboratively on Perusall by discussing, giving feedback to each other's, reading, and enriching comments through this social reading tool. Also, seeing the majority's com-

ments on key points and reading material affected their learning experience. It was important that although Perusall was used at the beginning of the course, the students recalled Perusall and they talked about it a lot. Moreover, there were suggestions on using Perusall more in the course. This shows that Perusall had a big interaction with students' asynchronous learning experiences. On the other hand, there were students who found the content of Perusall's readings uninteresting, so they participated low to discussion. Therefore, it is important that, although Perusall is a tool for collaboration, the content is also important. Perusall provided opportunities for students to interact with the text and with each other by using the tool's sharing and communication features. Since the beginning of online education, there has been research into the online discussion board as the primary tool through which students can build community and higher cognitive thinking in virtual environments (Mazzolini and Maddison, 2007). Wilson and Adams (2020) suggested that there was a benefit of utilizing a collaborative annotation tool such as Perusall to develop a community in online environments. They suggested that "during reading" discussion activities such as Perusall could serve as more authentic spaces for building community in an online environment, as they capture the current thought rather than the final product posted to the standard discussion board (Wilson and Adams, 2020).

In 2021, Kraut analyzed the use of CA tools such as Perusall in asynchronous environments with the lens of CoI. They concluded that CA has the potential to promote teaching presence, social presence, and cognitive presence of CoI in the asynchronous environment. In line with this, our findings suggested that the instructor implementations with Perusall were parallel with some of the indicators of all presences of CoI. Social presence was the most promoted presence for Perusall and WhatsApp in the course. It was not surprising since the incorporation of Web 2.0 applications, especially social software to the online environments suggested to promote social presence (Richardson et al., 2009; Stephens and Roberts, 2017). It was also important that the participation of Perusall had an effect on student's grades. Making participation in discussions as a part of course grades was also suggested in the literature to promote social presence (Richardson et al., 2009). Moreover, clearly indicating students

this grading process was a teaching presence implication (Rovai, 2000). Kraut (2021) argued that the role of the instructor, which is in the teaching presence, is vital to incorporate CA successfully into online learning environments.

Teaching presence mediated all these processes including social and cognitive presence. To be able to understand how teaching presence is experienced and implemented through this tool, it is important to discuss the instructor's role in the Perusall. The first role of the instructor was to update materials and assign students. This was the direct instruction category of teaching presence (Garrison, 2017). The instructor did not participate in Perusall postings. The purpose of not participating in the discussions was to not influence the students' ideas and to allow them to write their thoughts freely. The instructor thought that if she/he participate, students would avoid freely expressing their ideas. This approach was parallel with Richardson's (2009) suggestion for teaching presence which suggests in online discussions, the teacher should avoid being excessively "present", instead of facilitating student presence interaction (Richardson et al., 2009). In line with this, Watson (2007) warned instructors to avoid posting their ideas too soon because it can stop students' discussion for establishing teaching presence (Watson et al., 2017). However, Watson (2007) also suggested that the instructor should be active in the discussion board for teaching presence. In Perusall, the instructor was not active, but she/he was continuing Perusall discussions in some of the face-to-face classes and actively participated in them. In other words, the instructor designed face-to-face lessons to be discussed over the Perusall readings to highlight the importance of the discussions there and to talk about what the students were discussing. In 2012, Aydemir conducted a study with pre-service teachers in Turkiye to understand the effect of blended learning on pre-service teachers and indicated that face-to-face and asynchronous components create a ground for each others in the blended learning process.

In this research, nonparticipating in Perusall reflected a lack of facilitation among students. The instructor used face-to-face classes to facilitate students to be active on Perusall. Also, clearly introduced students to the importance of using Perusall and

announced that she/he wanted them to participate. It was important for ensuring teaching presence to clearly introduce students to the unique nature and learning potential of online discussion (Richardson et al., 2009). There were also rules for Perusall postings as Lowenthal and Parscal, (2008) suggested to structure collaborative learning activities for teaching presence. The interview findings suggested that this structured environment facilitated students' contributions on Perusall. On the other hand, the instructor follows and controls students' activities with the features of Perusall. The Perusall features enable the instructor to get data about students' activities and there were reports. The instructor was often using these features to monitor and control students in the asynchronous environment. Planning, managing, and monitoring CA activities was indicated as facilitating discourse and suggested promoting teaching presence (Kraut, 2021). This process is important to check students' processes such as their understanding, or dominant and timid participants. In this way, the instructor was planning to increase students' participation and achievements in this environment. Based on the findings from instructor interviews, the reason why the teacher creates a mechanism to control students in an asynchronous environment is because their self-regulation skills need to be supported. In fact, the instructor stated in the interview that such a control mechanism should not actually exist, but unfortunately, it was necessary. Contrarily, Cho and Heron (2019), found that excessive control and monitoring in the asynchronous learning process can hinder students' ability to develop self-regulation skills to take ownership of their learning. It is important to strike a balance between controlling and allowing students to develop their self-regulation skills considering the participants to be pre-service teachers, it may be expected for them to improve their self-regulation of learning. However, the students perceived this approach of the instructor as surveillance. They thought that the instructor was always watching their process. It was the management of students' interaction.

8.2.2. Learning Management and Teaching Presence

For the second asynchronous practice the instructor planned an environment to share documents and to provide an environment for students to ask questions. For

this purpose, used a learning management system (LMS) which is Moodle. Here the instructor shared course documents and opened a forum for students to ask questions to the instructor and their peers when they need help. Designing and planning through LMS was an important implementation for teaching presence (Garrison, 2017). The findings show that there were rubrics, syllables, and important due dates for asynchronous activities. In line with this Richardson et al. (2009), indicated that clearly indicating course goals, expectations, schedule, and rubrics for learning activities are important implications for teaching presence. Moreover, there are many studies that suggest that LMS are effective and important tools for asynchronous learning and teaching (Kerimbayev et al., 2016; Mpungose, 2019). In fact, Moodle found as a valuable tool to make asynchronous learning more effective (Kerimbayev et al., 2020). In this course, students found Moodle a useful and organized environment and it is preferred for document sharing and learning management. Similarly, Luk et al. (2018) found that students' perception of using Moodle was positive in their study conducted in China because it easily disseminates content knowledge by seeking them to use their formal experience to download the readings, module outlines, and slides. On the other hand, in the course, students did not prefer to use the forum feature of Moodle that the instructor opened. It was important to find that there were no students who ask a question on Moodle's forum. In fact, rather than asking questions in the forum, they were sending direct e-mails to the instructor. At this point, the instructor created a WhatsApp group to respond to students' needs. WhatsApp is also an easier tool to manage for the teacher, rather than replying to everyone individually by mail.

In parallel with this implication, Richardson et al., (2009) indicated that the online courses should be designed for learner choice, flexibility, and control for teaching presence. Through the lens of CoI, Zulkanain et al. (2020) found that the framework positively supports using WhatsApp in asynchronous learning environments. In addition, Seckman (2018) suggested using real-time communication tools especially to support social presence. Richardson et al., (2009) suggested that providing opportunities for students for public and private interactions supports teaching presence. The emergence of it as a learning tool was something the instructor did not plan at the be-

ginning of this course. Although there was face-to-face interaction in the lesson, there was also a need for asynchronous interaction, since learning is multidimensional, then interaction should not be limited to face-to-face only. The instructor adapted WhatsApp, for students' needs through the course. In WhatsApp, there was a rapid increase in the interaction between students and the instructor. Interacting with the instructor such as asking questions, taking quick feedback, and getting help through WhatsApp affected their learning process. The instructor was contributing to WhatsApp discussions regularly which was an important application for teaching presence (Lowenthal and Parscal, 2008). Students created a learning community through WhatsApp and the instructor guided, facilitated, and directed them with the discussions, questions, and answers. Therefore, the findings suggested that the instructor's implications on WhatsApp were parallel with suggested implications for teaching presence, cognitive presence, and social presence in literature.

Richardson et al., (2009) suggested encouraging students to share their experiences and beliefs in asynchronous discussions to suggest social presence. In parallel with this, Lowenthal and Parscal (2008) suggested to instructors share personal stories, emotions, and professional experiences, and address students by their names to provide social presence. Also, for teaching presence, showing instructors' character, personality and using humor is suggested (Dunlap and Lowenthal, 2018). In this research, the participants many times highlighted the instructors' characteristics and personalities when explaining their learning experiences. In addition, Stewart (2017), suggested explicitly introducing the importance of students-students interaction for social presence and teaching presence. The observation notes on WhatsApp suggested that the instructor many times indicated the importance of interaction and encouraged students to interact more. Also, it might be the reason for the emergence of interaction with peers as a most indicated code for WhatsApp. The instructor-student interaction was also the most indicated code, and the implications of the instructor were also suggested by literature to support teaching presence. The findings were parallel with Dunlap and Lawenthal's (2018) suggestions on creating opportunities for students to solve their problems and Watson et al. (2017) suggestions for preparing timely re-

turns and immediate feedback to assessments and prompting responses to students for teaching presence.

Stephens and Roberts (2017), proposed to establish a social climate for communication to contribute to learning experiences and to encourage students to discuss and to show multiple perspectives for teaching presence. In WhatsApp, students found a way to share their learning experiences, their struggles, and their needs, they helped each other by giving feedback through WhatsApp. In line with our findings, Basitere and Mapatagane (2018) found that integrating informal e-learning platforms such as WhatsApp into learning environments enables students to use their informal experiences to create interaction among students and greater engagement with content. The findings suggested that although WhatsApp is not a teaching and learning tool, it was an effective tool in the student's learning experience in the course.

In 2018, Khoza and Mpungose conducted a case study on the use of Moodle by first-year students at a South African university and they found that students enjoyed using Moodle to download the readings and module outline. However, the study summarized that students were disappointed with Moodle as they did not find the discussion forum user-friendly for active interaction; instead, they chose to create a WhatsApp group for proper discussion and sharing of ideas (Khoza and Mpungose, 2018). This shows that Moodle is good at meeting content knowledge needs by disseminating module content but lacks in terms of effective social communication needs that allow students to share their ideas. This indicates that social media platforms such as WhatsApp can be used as additional tools to support Moodle. Similarly, Sayan (2016) suggested that informal platforms such as WhatsApp, Facebook, and Twitter have an important role to address communication needs during the asynchronous learning process because these platforms allow for the interaction of students' experiences. WhatsApp was found the most important and recent platform used by students worldwide with the features of transforming the teaching and learning process from a formal to a more social, open, and user-friendly process (Salmon, 2013). Here the communication needs may be instant communication needs or asynchronous communication

needs because the students were already communicating in face-to-face classes. The findings also suggested that the most highlighted feature of WhatsApp was easy to use which is parallel to user-friendly. They were familiar with WhatsApp and are good at using this platform. Mpungpse (2019) indicated that the effective use of e-learning platforms (formal, informal, and widespread) is influenced by students' personal experiences. Therefore, it was important that preferring WhatsApp in the course may be affected by students' cultural backgrounds and personal experiences. It's important to consider cultural settings when examining a learning environment. The most used social media and messaging application by individuals in Turkey is WhatsApp with 82.0% (Turkish Statistical Institute, 2022). Therefore, students were familiar with WhatsApp, and this might allow students to see WhatsApp as a convenient and accessible tool. In addition, on average for countries in the Covid-19 period, WhatsApp usage has jumped by 51% (Perez, 2020). Thus, the use of WhatsApp can meet the social communication needs of the next generation of digital-age students who are more familiar with these informal platforms (Saha and Karpinski, 2018). Our findings suggested that the quick communication feature of WhatsApp was also the most highlighted feature. It was reasonable since it is an instant massaging tool, but the interaction of quick communication features with learning was important.

Despite their apparent advantages, the use of social media tools in education is discussed (Dron and Anderson, 2014; Garrison, 2017). In fact, in this lesson, the instructor did not want to use WhatsApp, she/he thought it was a violation of private space. But she/he felt having to use it because she/he couldn't find another tool to provide instant communication to enhance interaction for the course. In fact, the search for a tool such as WhatsApp, which can be communicated quickly and used by students comfortably, but which will not interfere with private life, continues, for future lessons. So, she/he wants to continue using these features of WhatsApp, but at the same time, she/he was uncomfortable using it. Similarly, Benson and Morgan (2018) conducted a study in London and pointed out the importance and challenges of adopting WhatsApp to the teaching and learning process. The study found that WhatsApp provides a student networking space for collaboration, but the study further

highlighted that university policy should address issues of privacy, information security, and other challenges before using WhatsApp (Benson and Morgan, 2018). In addition to privacy issues, our findings suggested that the overlooked feature of WhatsApp was another limitation that emerged in our study. In other words, it turned out that because there is a fast message flow on WhatsApp, some messages were overlooked because they were at the bottom. Since the purpose of this study is not WhatsApp, we did not collect data in that context, but for further research, it may be useful to study setting norms for WhatsApp, since it turns into an important medium in asynchronous education.

Overall, the findings showed that Moodle as an official e-learning platform has its own strengths and limitations; this also applies to WhatsApp as an unofficial e-learning platform. It seems that Moodle is good at officially opening module content such as downloading documents and adding extensions, but not as good at creating proper social group discussions as WhatsApp does. Moreover, WhatsApp is not good at sharing documents because of overlooked features. So, Moodle and WhatsApp were not enough on their own. Similarly, Mpungose (2019) concluded that no single platform (WhatsApp or Moodle) can meet all their needs while teaching and learning. In the study, when WhatsApp started to use Moodle was still used, for source sharing WhatsApp failed to replace Moodle. In fact, there were examples such as when the instructor shared a document on Moodle, she/he introduced students through WhatsApp to control Moodle. Instead of doing this, she/he could have shared documents directly from WhatsApp, but she/he did not, she/he shared it on Moodle because it was seen as a more organized and stable environment. But she/he announced on WhatsApp that he was sharing on Moodle because he wanted to inform quickly. In other words, these two tools were used for different purposes, they did not replace each other. Therefore, researchers suggested that the instructors should consider an informal platform (WhatsApp) to support formal learning tools (Moodle) to meet students' needs (Mpungose, 2018). In terms of teaching presence experience, both Moodle and WhatsApp were important tools in the course. In fact, the intense teaching presence experiences observed on these tools. In Moodle, design and organization which is one

of the important categories of teaching presence provided with the tool features such as syllables sharing, announcements, date lines, or document sharing. On the other hand, WhatsApp was the main tool to experience facilitation and direct instruction categories of teaching presence in the course. This tool enabled students to reach the teacher and their classmates immediately whenever they need. Also, in the interview findings, students explained their teaching presence experiences mostly referring to their WhatsApp experiences. There may be a lack of facilitation and direct instruction in terms of teaching presence if WhatsApp were not used. In addition to that in our study when the collaboration features the most highlighted of Perusall, the interaction emerged for WhatsApp. In other words, WhatsApp emerges more as a means of communication. These tools were used for different and unique needs in the asynchronous environment and there were a balance and coherence between them.

8.2.3. Dynamic Geometry Software and Teaching Presence

The most strong and active interaction on WhatsApp occurred at the end of the semester when the students work on final projects. This project was also the third practice of the asynchronous environment which is a dynamic mathematics software (DGS) activity. GeoGebra was used for this activity. The DGS using is emphasized for teaching geometry concepts (MoNE, 2006). In Tukiye, the curriculum reform also suggested using DGS (Bulut, 2007). Therefore, it was important to learn to use tools and to prepare lesson activities with DGS for preservice mathematic teachers. In the GeoGebra environment, the student's learning experience emerged as working on tasks and learning from instructors' examples. Therefore, in the GeoGebra environment, students were passive in terms of collaboration and communication. However, at the same time, it was important finding that working with GeoGebra facilitated students' collaborative interactions on mathematical topics. Holeys and Noss (2009) also found that using DGS such as GeoGebra has been shown to effectively support students' mathematical discourse. The use of a DGS forces them to be a community and interact, and even this communication takes place over WhatsApp instantly. When students need social interaction to work on GeoGebra, WhatsApp groups was used more for communica-

tion. When students have technical or content-related questions about the GeoGebra, they asked their questions and discussed more through WhatsApp. In parallel with our findings, Richardson et al., (2009) suggested designing collaborative activities such as problem-solving, tasks, and projects which means community-building activities for social presence. Also, GeoGebra activity is useful for cognitive presence since using simulations and other interactive activities supports convergent thinking (Richardson et al., 2009). Student work on GeoGebra as a group and use group work strategies suggested for teaching presence (Lowenthal and Parscal, 2008). In line with this, Dunlap and Lowentral (2018), suggested using collaborative group projects for teaching presence. Moreover, the findings were parallel with suggestions for teaching presence such as structuring learning activities (Lowenthal and Parscal, 2008). In addition, when students have questions and need support, the instructor gives place to GeoGebra in a face-to-face environment. Carrying this environment to the face-to-face class also supported face-to-face collaboration. In general, the pre-service teachers experienced a mathematical tool learning and tool-related collaboration on WhatsApp, while designing a teaching mathematics activity on GeoGebra. It was important that GeoGebra is the purpose of the course and the content, but it was also used as a tool in the asynchronous environment.

8.3. CoI Model as Analytical Framework

The CoI framework is a guiding framework for blended and online learning implementations. The main emphasis of the framework is to create an effective learning community through the development of social, cognitive, and teaching presences. In the study, the main purpose was to explore the teaching presence experience of pre-service mathematics teachers in the asynchronous learning environment. The reason for focusing on teaching presence was its' important stand and interaction with a social and cognitive presence within CoI. According to Garrison (2017), the instructor is still key, even when students managed the process of directing discourse. Garrison (2021) described teaching presence as the connective tissue of an effective community of inquiry. In the study, the relationship between the three presences emerged from

the interview data. In the interview, there were emerging data for social and cognitive presence although the main questions asked to students was to learn about their experiences on teaching presence. Also, there were codes that included more than one presence. In the nature of the CoI framework, the presences are interrelated and interact with each other. The literature suggested the relationship between CoI presences such as more cognitive presence and social presence found for higher teaching presence and, teaching presence described as a strong predictor for social and cognitive presences (Akyol and Garrison, 2008; Caskurlu et al., 2020). It was found from the survey results that all presences were perceived as high. In addition, interview findings show that emerged codes completely matched with the CoI indicators, and the framework captured the asynchronous implementations of the blended course for all presences.

In the CoI framework, teaching presence is categorized as design, facilitation, and direct instruction. Asynchronous teaching requires an extensive planning process for meaningful learning experiences. In the CoI framework designing strategies are suggested as tentative and flexible rather than a rigid template (Garrison, 2017). In parallel with this, in the pre-interview, the instructor explained her/his planning process before the course begin as a generally planned environment, activities, tools, and projects. In the post-interview and students' interview findings, it was also found that there were some changes in the course design for students' needs. The facilitation category of CoI reflected in the study as the instructor management and monitoring process through course activities. The instructor used tools' features for facilitation. Also, asynchronous, and face-to-face components interacted with instructors' facilitation strategies. The direct instruction strategy strongly suggested to contribute discourse (Anderson et al., 2001). In the study, the direct instruction strategy helped students to increase the effectiveness of their learning experience. In line with this, Garrison and Vaughan (2008) suggested for cognitive presence to ensure direct instruction.

As a conclusion, teacher education plays a crucial role in preparing educators to effectively engage students in meaningful learning experiences. In recent years, there

has been growing interest in exploring innovative pedagogical approaches to enhance the quality of teacher education programs. One such approach is the implementation of the Community of Inquiry (CoI) framework, which emphasizes collaborative and inquiry-based learning in online and blended environments. However, the current literature indicates a need for further studies investigating the application of the CoI framework in teacher education contexts. Considering these issues this research study provided an exploration of "how" and "what" of asynchronous experiences developed teaching presence and other presences. The results suggested that teaching presence developed with the instructors' course design, management, facilitation, and direct instruction strategies. The tools interact with these experiences. Teaching presence is experienced through the tools' features and the instructor's role with these tools. In studies examining a community of inquiry development, a small number of participant groups are preferred in order to control group discussions and conduct the process more effectively. (Akyol et al., 2009; Akyol and Garrison, 2011). In the case study within the scope of this research, the number of participants was also kept at a limited level. Due to the small number of sizes, the findings cannot be generalized. In addition, each learning environments have unique features. Therefore, CoI development in a learning environment may vary. However, the instructors can use the CoI framework to design and implement effective asynchronous learning environments by taking into consideration the differences.

9. LIMITATIONS AND SUGESTIONS

In this section, the limitations of the study and suggestions for further studies are introduced. During the study, there were some limitations. The main limitation might be the small number of participants. Due to the examination of one specific course and the study's qualitative approach, the number of participants was limited. On the other hand, a small number of participants were intentionally selected for the study to be able to explore their learning experiences in terms of teaching presence. Therefore, the findings of this study cannot be generalized. In further research, the experiences of pre-service mathematics teachers in terms of teaching presence in asynchronous learning environments should be studied with a higher number of participants to extend the results of the study.

Additionally, the quantitative data from the CoI survey was used for selecting interview participants and to get a general sense of participants. There might be more qualitative analysis, findings, and conclusions in the study. The number of participants also affected the making quantitative analysis. In further studies, more detailed quantitative analysis may be used to support the findings

Another limitation of this study was that the face-to-face observation notes did not analyze. If there was a scale for the analysis of observation notes, these observation notes could be analyzed. In addition, the online postings and discussions of the asynchronous environment did not analyze, they were used as secondary data sources. In further studies, more data should be collected from the research field, and they should be analyzed with the appropriate methods. In this way, the experiences can be explored deeply. Lastly, the CoI survey was implemented in English since the course was taught in English. Also, there is no Turkish version of the instrument. The instrument may be translated into Turkish for further studies. In this way, the participants may understand the survey items more clearly.

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APPENDIX A: THE INSTRUCTOR'S PRE-INTERVIEW QUESTIONS

- How do you introduce and describe this course?
- How you designed and planned the asynchronous component of the course? Which practices and tools will be included?
- How are the asynchronous components of the course will be included in the whole course when you compare face-to-face components?
- What are your previous experiences with online and blended teaching and learning?

APPENDIX B: THE INSTRUCTOR POST-INTERVIEW QUESTIONS

- How did you design and implemented several practices of the asynchronous environment of the course?
- How did your design change when you think about your pre-designs for the course and especially for the asynchronous components?
- What was your role in the asynchronous learning environment as a teacher educator?
- Did you use a direct instruction strategy through your asynchronous teaching experience? How? Why?
- When you think about your experiences on the asynchronous components of this course, what would you change for your future designs?

APPENDIX C: STUDENTS INTERVIEW QUESTIONS

- When you think about your asynchronous learning experience in the course, how do you describe the design and organization of the course?
- When you think about your asynchronous learning experience in the course, how did you experience facilitation in the course?
- When you think about your asynchronous learning experience in the course, how did you experience direct instruction in the course?
- How have you experienced learning activities in the asynchronous environment such as online discussions, group works, assignments, final projects, etc. (Perusal, Moodle, GeoGebra, etc.)
- Do you think that a community developed in the asynchronous environment? How do you describe about the community?
- What suggestions or recommendations can you provide in order to increase the effectiveness of the asynchronous component of the course?

APPENDIX D: COMMUNITY OF INQUIRY SURVEY

Demographics

1- Name- Surname:

2- How many and which Sced courses have you taken in your program?

3- Have you taken any online or blended courses before? If yes, how many courses have you take, which?

Figure D.1. Demographic information.

Community of Inquiry Survey (Teaching Presence)

Please rate the followings statements based on your experiences during **asynchronous components of this course.**

About your **asynchronous** learning experience.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Teaching Presence					
,4. The instructor clearly communicated important course topics.					
5. The instructor clearly communicated important course goals.					
6. The instructor provided clear instructions on how to participate in course learning activities.					
7. The instructor clearly communicated important due dates/time frames for learning activities.					
8. The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn.					
9. The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking.					
10. The instructor helped to keep course participants engaged and participating in productive dialogue.					
11. The instructor helped keep the course participants on the task in a way that helped me to learn.					
12. The instructor encouraged course participants to explore new concepts in this course.					
13. Instructor actions reinforced the development of a sense of community among course participants.					
14. The instructor helped to focus the discussion on relevant issues in a way that helped me to learn.					
15. The instructor provided feedback that helped me understand my strengths and weaknesses relative to the course's goals and objectives.					
16. The instructor provided feedback in a timely fashion.					
17. How do you describe your asynchronous learning experience in terms of teaching presence?					

Figure D.2. CoI survey (teaching presence).

Community of Inquiry Survey (Social Presence)

Please rate the followings statements based on your experiences during **asynchronous components of this course.**

About your **asynchronous** learning experience.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Social Presence					
,18. Getting to know other course participants gave me a sense of belonging in the course.					
19. I was able to form distinct impressions of some course participants.					
20. Online or web-based communication is an excellent medium for social interaction.					
21. I felt comfortable conversing through the online medium.					
22. I felt comfortable participating in the course discussions.					
23. I felt comfortable interacting with other course participants.					
24. I felt comfortable disagreeing with other course participants while still maintaining a sense of trust.					
25. I felt that my point of view was acknowledged by other course participants.					
26. Online discussions help me to develop a sense of collaboration.					
27. How do you describe your asynchronous learning experience in terms of social presence?					

Figure D.3. CoI survey (social presence).

Community of Inquiry Survey (Social Presence)

Please rate the followings statements based on your experiences during **asynchronous components of this course.**

About your **asynchronous** learning experience.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Cognitive Presence					
28. Problems posed increased my interest in course issues.					
29. Course activities piqued my curiosity.					
30. I felt motivated to explore content related questions.					
31. I utilized a variety of information sources to explore problems posed in this course.					
32. Brainstorming and finding relevant information helped me resolve content related questions.					
33. Online discussions were valuable in helping me appreciate different perspectives.					
34. Combining new information helped me answer questions raised in course activities.					
35. Learning activities helped me construct explanations/solutions.					
36. Reflection on course content and discussions helped me understand fundamental concepts in this class.					
37. I can describe ways to test and apply the knowledge created in this course.					
38. I have developed solutions to course problems that can be applied in practice.					
39. I can apply the knowledge created in this course to my work or other non-class related activities.					
40. How do you describe your asynchronous learning experience in terms of cognitive presence?					
41. When you think about your asynchronous learning experiences in the course (Perusal, Moodle, GeoGebra), how do you describe the effectiveness of your learning experience?					
42. If you were the instructor of this course, what would you change in the asynchronous learning environment? How would you design and plan an asynchronous learning and teaching experience?					
43. Do you have any other insights about your asynchronous learning experience?					

Figure D.4. CoI survey (cognitive presence).