Higher Education Studies; Vol. 6, No. 2; 2016
ISSN 1925-4741 E-ISSN 1925-475X
Published by Canadian Center of Science and Education

A Multi-Perspective Investigation into Learners' Interaction in Asynchronous Computer-Mediated Communication (CMC)

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Received: February 10, 2016 Accepted: February 27, 2016 Online Published: April 6, 2016

doi:10.5539/hes.v6n2p61 URL: http://dx.doi.org/10.5539/hes.v6n2p61

Abstract

This article focusses on graduate level students' interactions during asynchronous CMC activities of an online course about the teaching profession in Turkey. The instructor of the course designed and facilitated a semester-long asynchronous CMC on forum discussions, and investigated the interaction of learners in multiple perspectives: learners' views, participation in terms of quantity, participation in terms of discussed issues and collaborative construction of new knowledge. 14 graduate students were participated in the study and 12 of them were interviewed. Meanwhile, 345 messages sent by the learners and the instructor were analyzed in order to identify discussed issues and social construction of knowledge. The results of the study showed that according to the message numbers and views of the learners, learner-instructor interaction was ahead of learner-learner interaction. Meanwhile, learner-content interaction was sustained by various discussion topics. Though learners' views related to learner-learner, learner-instructor and learner-content interactions were positive in general, analyzing the contents of the messages didn't reveal higher levels of co-construction of knowledge according to the Interaction Analysis Model.

Keywords: computer-mediated communication, online discussion, Interaction Analysis Model

1. Introduction

This article reports a case in which an instructor of a graduate level online course designed and facilitated asynchronous CMCs by following the strategies suggested by Rovai (2007), and investigated the interactions in multiple perspectives to understand the quality of participants' interactions. The perspectives considered in the study for the evaluation of the quality of interactions are learners' views, participation in terms of quantity, participation in terms of discussed issues, and social construction of knowledge. Considering the constructivist structure of the online course of the present study, these perspectives seem to be important. Firstly, because the learners' perspectives about their interactions might have affected the quality of the CMCs, learners' views regarding their interaction with the content, other learners and the instructor during asynchronous CMCs were investigated. Secondly, because the social interaction (learner-learner, learner-instructor interactions) during CMCs requires explicit participation, the quantity of the learners' explicit participation was also reported. Additionally, topics the graduate students discussed under the units of the course were regarded for the learner-content interaction. Finally, learners' interactions were examined in terms of social construction of knowledge by using Interaction Analysis Model (IAM) (Gunawardena, Lowe, & Anderson, 1997) since the online course required social construction of knowledge, and the ultimate goal of including asynchronous CMCs into the course program was to encourage social interaction and active engagement of learners in learning.

2. Literature Review

Participating in learning activities is considered as one of the important factors which enhance learning. To enable students' active participation in an online learning environment where the learners and the instructors are separated from each other in terms of time and space, the instructor or the course design team should include some kinds of activities which bring interaction into the learning-teaching process of the course program. Interaction is defined as a way learners and instructors communicate their ideas, perspectives, feelings and knowledge, and also comprehend them (Sutton, 2001). Previous studies support the contributions of interaction into learning process and learners' satisfaction (e.g., Arbaugh, 2000; Arbaugh & Benbunan-Fish, 2007; Çardak, 2012; Demirer & Sahin, 2013; Kuo, Belland, Scroder, & Walker, 2014; LaPointe & Gunawardena, 2004; Quek,

2010; Rovai & Barnum, 2003; Sher, 2009). Sher's (2009) study highlights learner-learner and learner-instructor interactions as a significant contributors of learning and satisfaction. Rovai and Barnum (2003) report active interaction in online graduate level courses as a significant predictor of perceived learning. Similarly, the study of LaPointe and Gunawardena (2004) reveals direct effect of self-reported peer interaction on self-reported perceived learning outcomes. The dissertation of Çardak (2012) reports student satisfaction with a blended learning activities which require learner-learner and learner-instructor interactions.

According to the constructivist approach, knowledge is constructed by the learners during their interactions in the learning environment (Su, Bonk, Magjuka, Liu, & Lee, 2005). Learner-learner and learner-instructor interactions are very valuable social interactions for online learning-teaching processes especially based on social constructivism. According to Moore's (1989) classification of interaction types, learner-content interaction is also very important for learning besides learner-learner and learner-instructor interactions. Learners need to read and think on the content of the subject being studied, and should also contribute to the content with her/his ideas, experiences, and examples.

While designing interaction for web-based instruction, Moore's (1989) classification of interaction serves as a useful guide (Gunawardena, 1999). Various teaching methods and learning activities supporting collaboration may enhance the quality of all three types of interactions if designed wisely. Therefore, instructors should provide activities in order to help learners collaborate (Elbaum, Mclntyre, & Smith, 2002).

Including Computer-Mediated Communication (CMC) or computer-conferencing synchronously or asynchronously into the online course is an important way to support interactions and therefore the collaboration. Exchanging messages among a group of users via a network of computers in order to discuss an issue appealing to both sides' interest is termed CMC (Gunawardena et al., 1997). Indeed, according to Rovai (2007), the CMC is very important for community building which is necessary for the quality of online interaction.

Though CMC is the "primary mechanism" (Rovai, 2007, p. 78) for community building, conducting discussions online via CMCs could not guarantee the quality of the interactions in all cases. However, the amount and the quality of interaction have a key role in the learning (Mishra & Juwah, 2006), and CMCs should ensure more and qualified interactions. Thus, instructors should design the CMC component of the online course and facilitate it in a manner to ensure higher quality interactions. In the literature, there are many studies providing evidence-based strategies for high level of interactions and meaningful discussions during CMCs, especially the asynchronous ones because of their flexibility of time and space (e.g., De Wever, Van Keer, Schellens, & Valcke, 2009; De wever et al., 2010; Gilbert & Dabbagh, 2005; Hew & Cheung, 2012; Rovai, 2007). As one of the important studies focusing on effective strategies for CMCs, Rovai (2007) lists some strategies for effective design and facilitation of CMCs, especially for the asynchronous ones.

The first strategy for the design of CMC is devoted to motivation (Rovai, 2007). Learners need "strong motivation and encouragement to put in the necessary time and effort" (Salmon, 2004, p. 31). According to Rovai (2007), though some learners may have intrinsic motivation, some components for extrinsic motivation such as grading the participation in online discussions must be provided for the rest. Hew and Cheung (2012) also address a widely used strategy of making the online discussions mandatory or providing incentives such as grades for the participation into discussions.

Another strategy for effective CMC design is providing clear expectations regarding what are the requirements of the learners (Bender, 2003; Nandi, Hamilton, & Harland, 2012; Rovai, 2007) such as frequency of participation, the weight of the participation in the final grade, and the style of communication, etc. (Bender, 2003). Using a rubric and clearly conveying expectations are helpful for learners to judge their participation (Rovai, 2007). Hew and Cheung (2012) also highlight the importance of providing clear explanations regarding the purpose of online discussions. If the students do not comprehend the purpose of an online discussion, they might not pay due attention to this activity.

The next strategy for designing online discussions is providing socio-emotional discussions to improve the sense of community (Rovai, 2007). Rovai suggests a separate discussion forum for learners to share their mutual interest topics. Similarly, a virtual "café" for socialization might be provided (Salmon, 2004). Among Bender's (2003) suggestions, designing a topic for informal first discussion, providing an opportunity to introduce each other, playing a game, and using an icebreaker activity might be employed to enhance a strong sense of community.

Another design strategy is provision for task-oriented discussions. Rovai (2007) suggests task-oriented authentic discussion topics which support collaboration and construction of knowledge. Herrington, Reeves and Oliver (2006) define some principles of authentic online learning tasks such as real-world related, comprising complex

tasks and ill-defined which means ill-structured tasks with some unknown elements.

Designing the environment is not enough for successful asynchronous CMC, it also requires effective facilitation. Thanks to previous studies (e.g., Bender, 2003; De wever et al., 2010; Hew & Cheung, 2012; Rovai, 2007; Salmon, 2004), the facilitation strategies in the literature for CMC are very helpful for the online instructors. Besides the instructor facilitator, students could also facilitate the discussions (e.g., Baran & Correia, 2009; Hew & Cheung, 2011), if they have knowledge about facilitating (De Smet, Keer, & Valcke, 2008; Gilbert & Dabbagh, 2005), and various roles such as starter, summarizer, moderator, theoretician, and source searcher could be assigned to students (De Wever et al., 2010).

In the study of Rovai (2007), there are five strategies for facilitating online discussions. The first facilitating strategy is related to social presence, and developing and maintaining social presence during asynchronous CMC (Rovai, 2007). Giving students positive feedback in time, increasing familiarity among the members, following the discussions and moderating via appreciation, agreement, and supporting might be helpful to develop and maintain social presence (Rovai, 2007). Integrating synchronous online communication tools or discussion activities might also support social presence. Oztok, Zingaro, Brett and Hewitt (2013) report contributions of synchronous private messages to the asynchronous discussions.

Another facilitating strategy is emphasis on student-student interactions. Instructors should support student-student interaction and avoid becoming the center of discussions (Rovai, 2007). Rovai suggests not responding to messages immediately in order to provide time for students to answer first, providing encouragement and directing discussions instead of directly answering the questions, assigning summarizer role-like responsibilities to the learner and/or providing closure to discussions, and dealing with aggressive discussions and silent learners. Some learners might still choose to participate as lurkers, "who silently take in the contributions of others" (Gunawardena, Lowe, & Anderson, 1998). Lurkers actually choose vicarious interaction while keeping their silence.

Cultural and gender-based communication patterns, and student status should also be considered as important issues for facilitating CMCs (Rovai, 2007). According to Rovai (2007), when cultural differences increase among the members of an online community, the potential for miscommunication also goes up. Thus, instructors should organize some activities to get the learners to know each other and encourage all learners to participate in discussions (Rovai, 2007). Gender-based communication pattern is also noteworthy for facilitating CMCs (Rovai, 2007). Herring's (1996) study reports gendered posting styles in CMCs. In a meta-analysis study on gender differences in CMCs, the results demonstrate gender-related patterns during communication; females are more collaborative and personal-oriented (Li, 2005). Similary, Rabab'ah (2013) study also highlight differences between females and males during CMCs. Moreover, Erdem-Aydın (2012) reports significant differences between females' and males' attitudes towards online communication related to three dimension of the attitude scale; social connection, misconception and easy. If females' and males' approaches to asynchronous discussions might be different, then it is reasonable for an instructor to create collaboration among the participants (Bender, 2003). Additionally, the instructor as an e-moderator should concentrate on individuals' contributions to CMC rather than their gender (Salmon, 2004). The last strategy is dealing with student status (Rovai, 2007). If low and high status learners co-exist, among online learners, low-status learners might participate timidly. An instructor should intervene indirectly to create an equal status in online classes (Rovai, 2007).

Designing and facilitating asynchronous CMC according to the effective strategies in the literature is the responsibility of online instructors. Yet, the other side of the coin entails assessing the quality of interactions during CMC activities. While assessing the quality of learners' interaction during asynchronous CMCs, examining learners' satisfaction and the participation regarding who participated, when, how and how much might be essential. Whereas the former provides the perspectives of the learners, the latter present quantitative results related to interaction. However, these inquiries alone might not be enough to identify the degree of the quality of interactions. Thus, analyzing the transcripts of the discussions will produce more information about the quality of learners' interaction and learning experiences during CMC activities (Gunawardena et al., 1997).

Gunawardena et al. (1997) developed the Interaction Analysis Model (IAM) to assess the quality of asynchronous CMC structured in debate format, and designed for professionals in the field of distance education. According to them, "interaction is the process through which negotiation of meaning and co-creation of knowledge occurs" (p. 407). Content analysis was employed via the IAM model in various studies conducted on social constructivism and reporting the quality of the interactions that occurred in asynchronous discussions (e.g., Heo, Lim, & Kim, 2010; Hew & Cheung, 2011a; Hew & Cheung, 2011; Hou, Chang, & Sung, 2008; Lu & Jeng, 2006; Paulus, 2007; Tan, Chai, & Hong, 2008).

2.1 Research Questions

The purpose of this study was to understand the graduate students' online interactions during a semester long asynchronous CMCs. The following research questions were answered:

1) What were the views of the learners regarding their interactions with the content, other participant learners, and the moderator of the CMC?

2) What was the quantity of learners' participation during CMCs?

3) What were the discussed issues during CMCs?

4) In terms of the social construction of knowledge, how did the learners interact?

The answers to these questions might be helpful for the instructors who want to conduct asynchronous CMC at graduate level, and might shed light on future interaction analysis initiatives with respect to comparing the quality of interaction across the cultures and education levels.

3. Method

3.1 Research Design

The case study is related to a graduate level online course, "Instructional Planning and Evaluation" (IPE). It is limited to the one particular component, asynchronous CMC, of the online course.

PhD students from any subject area in Turkey should take two teaching profession courses at graduate level. One of them is IPE. The online course IPE has three main components at Anadolu University. The first component is individual studies of the units of the course. Students are given a summary and additional reading list for each of the units. The second component is weekly synchronous chats (an hour a week) in the virtual classroom of Adobe Connect, and the last component is weekly asynchronous CMCs in discussion forum of WebCT. The course has 11 units, and each unit is studied for one or two weeks.

For the current study, 14 weeks of asynchronous CMC sessions held within IPE course were examined in detail. The instructor created 11 main topics for 11 units of the course, and each week's unit was discussed under the related main topic in the discussion forum of the WebCT. The structure of the forum tool empowered both the students and the instructors to initiate any discussion topic or problem pertaining to the unit of the week. While designing and facilitating these CMC sessions, the instructor of the IPE tried to follow Rovai's (2007) strategies fundamentally.

The instructor of the course IPE moderated and participated in asynchronous CMCs. Hereafter in this article, "moderator" will be used instead of "instructor". Because during the CMCs, instructor of the course directed the discussions as a moderator of an online learning community.

3.2 Participants

Participants in this case study were the graduate students of the online course IPE. There were 14 students (11 female, 3 male), and at the end of the course term, all the students consented for the analysis of their discussion messages, and 12 of them participated in interviews voluntarily. The students of the course were attending various PhD programs (three learners from botanic and zoology, six learners from music and ceramics, two learners from industrial and chemistry engineering, two learners from finance and one learner from communication) at various institutes at Anadolu University. These adult learners had not attended an education related formal course and had never experienced any kind of online course before.

3.3 Data Collection

This case study included quantitative and qualitative data from two different data sources. The first data source was the transcripts of the asynchronous CMCs of the whole term. These discussion transcripts were gathered from the WebCT's logs and analyzed.

The second set of qualitative data was collected from the interviews with 12 students of the online course IPE. An interview guide approach was used for the interviews (Patton, 2002). For the interviews, the researcher developed an interview guide, and 10 experts of curriculum and instructional technologies were consulted. After a pilot interview with an ex-student of the online course IPE, the interview guide was finalized. At the end of the term, the researcher conducted 12 interviews with the volunteering participants and all the interviews were audio-recorded. The average duration of the interviews was 30 minutes for each session.

3.4 Data Analysis

Interview transcripts were analyzed through descriptive analysis whereas content analysis and descriptive statistics were conducted on the asynchronous CMC records.

3.4.1 Analysis of the Interviews

Before analyzing the interviews, interview records were transcribed into texts, and another researcher checked these transcripts. The researcher defined the themes based on research questions, interview questions, and the "general sense of information" gained from the first overall reading. Then the researcher coded the views of the students into the themes by descriptive analysis using the software Nvivo 8.

3.4.2 Analysis of the Quantitative Records of the CMCs

Descriptive analysis of the asynchronous CMC records was conducted to examine the students' participation quantitatively. Frequencies and the percent of the composed and replied messages sent by learners and the moderator were calculated.

3.4.3 Content Analysis of the CMC Transcripts

Two different content analysis were carried out on the asynchronous CMC transcripts of the 11 units of the course, and "a message" was taken as a unit of analysis. The contents of the 345 messages sent by the learners and the instructor were analyzed in order to identify discussed issues and social construction of knowledge. Therefore, each message was analyzed two times for two different content analysis.

The first content analysis was conducted to identify discussion topics under 11 units of the course. Because of the "compose message" button of the forums, learners occasionally composed messages while participating in a pre-initiated discussions though the moderator directed learners to use the "reply" button to participate in these discussions. Thus, identifying each separate discussion topics required reading the contents of the messages in detail, and revealing themes related to discussed issues.

The second content analysis was conducted to determine the quality of interactions by using the IAM of Gunawardena et al. (1997). Within this analysis, the degree of social construction of knowledge in asynchronous CMC was identified in order to determine the quality of the interactions.

IAM consists of five phases and operations for each phase (Gunawardena et al., 1997, p. 414):

- Phase I is "sharing/comparing of information", and includes five phases as sharing of observation or opinion, agreements, examples, clarifying answers or questions, and defining the problem.
- Phase II is "the discovery and exploration of dissonance and inconsistency among ideas, concepts or statements", and it includes three operations, which are identifying disagreement, clarifying disagreement through answers or questions, clarifying participant's positions.
- Phase III is "negotiation of meaning/co-construction of knowledge", and includes five operations such as negotiation of the meaning of the terms and weights to be assigned to arguments, identification of areas of agreement, proposing new statements, proposing accommodating metaphors or analogies.
- Phase IV is "testing and modification of proposed synthesis or co-construction", and includes five operations which are testing the new proposed ideas against participants' culture, cognitive schema, personal experience, formal data, and literature.
- Phase V is "applications of newly constructed meaning", and includes three operations; summarizing the agreements, applications of new knowledge, and metacognitive statements of the participants.

The asynchronous CMC transcripts of each message was analyzed according to these five phases and operations and coded accordingly.

3.4.4 Reliability Studies

For the reliability of the findings, inter-rater agreements were calculated according to Miles and Huberman (1994) for both interviews and asynchronous CMC transcripts. The inter-rater agreements for interview findings and for those derived from first conducted content analysis of the discussion transcripts were found to be 96% and 98% respectively. For the reliability of the findings derived from the second content analysis of the discussion transcripts regarding IAM, the inter-rater agreement was calculated to be 57%. This ratio might be moderate for such a difficult content analysis.

4. Results

The results derived from the interviews and asynchronous CMC records are presented in accordance with the research questions.

4.1 The Views of the Learners Regarding Their Interactions

Regarding the learner interactions, the theme set derived from the statements of the graduate students and the frequencies for each sub-theme are shown on Table 1.

Table1. Learners' interactions according to their views derived from interviews

Learner-content interaction	f
Gaining information during the search on the internet to participate in discussions	10
Learning the content during the asynchronous CMCs on forums	9
Finding some of the discussion topics very interesting	6
Real life related topics were more interesting	5
All of the topics were interesting	4
Negative Views:	
- Copying information from the Internet	4
- Having no contributions to learning	3
- Discussing many issues in a week	1
Learner-learner interaction	**f**
Sharing mostly academic information	5
High level of interaction between students studying the same subject fields	5
High level of interaction between students	2
Sharing mostly personal views and experiences	2
Discussing with students from different subject fields was so nice	2
Negative Views:	
- Not being at a desired level	5
- Not reading the other learners' messages	2
Learner-moderator interaction	**f**
Interaction because of moderator's successful guidance	9
High level of interaction with the moderator	6
Gaining feedback from moderator was nice and helpful for learning	4
Sharing mostly personal views and experiences	4
Sharing mostly academic information	3

According to the learners' views in Table 1, though they gained information related to the content of the course during the searches of the Internet to participate in asynchronous CMCs, those discussions also contributed to their learning as one of the 10 learners indicated below:

[Learner 7-"… it contributed to my learning. As I said, through examples, then different friends' sentences, definitions in their own words helped me understand better."]

During the asynchronous discussions in forums, various issues were discussed, and the learners' views regarding the discussion topics were also questioned. According to six of them, interesting topics changed from one learner to the other as expected, and five learners highlighted real life related topics.

In addition to positive views on learner-content interaction, some participants indicated four negative views about this interaction. Four learners declared that they copied and pasted the information from the Internet into their messages. Three of them stated that asynchronous CMC did not contribute to their learning. Additionally two more negative views were noted by two other learners: some of the discussion topics required much more theoretical knowledge and discussing many issues in a week in forums was difficult.

Regarding learner-learner interaction, five learners reported that they shared mostly academic information while two of them pointed out sharing personal views and experiences during asynchronous CMC with other learners. Additionally, according to the views of five participants, students studying the same subject fields interacted more amongst themselves than with the others. One of the students expressed his/her views on this theme as follows:

[Learner 10.-" ... Interaction with the friend studying the same field is better."]

Despite this comment, two learners highlighted a high level of interaction between the students regardless of their study fields. Indeed two other participants enjoyed discussing with other students studying in different fields. On the other hand, according to five of them, learner-learner interaction was not at a desired level and two of them complained about not reading the other learners messages.

Learner-moderator interaction was also questioned. The learners had positive views regarding the learner-moderator interaction according to the themes in Table 1. Six of them pointed to high levels of interaction and nine of them attributed this interaction to the moderator's guidance as one of the learners indicated below:

[Learner 3-"...who wrote or who did not write was followed very well, this was encouraging..."]

Four learners highlighted the feedback provided by the moderator. For them, the moderator's feedback was nice and helpful for learning. In addition, four learners stated that they shared mostly personal views and experiences while three of them noted that they mostly shared academic information with the moderator.

4.2 The Quantity of Learners' Participation during CMCs

Results related to the participation of learners and the moderator in terms of quantity during the asynchronous CMC for each unit of the online course IPE can be examined in Table 2.

Table 2. Frequencies and ratios of the learners' and the moderator's messages during the asynchronous CMCs in the forums for the units of the course IPE

Units of the Course IPE	Moderator				Learners				Tot.
	RM		CM		RM		CM		
	f	%	f	%	f	%	f	%	f
1.Basic Concepts	12	38.71	1	3.23	9	29.03	9	29.03	31
2.Components of a Teaching Process	21	44.68	3	6.38	23	48.94	-	-	47
3.Instructional Aims	8	38.10	3	14.29	10	47.62	-	-	21
4.Content of a Curriculum	13	44.83	2	6.90	14	48.28	-	-	29
5.Teaching-Learning Process	13	41.94	2	6.45	16	51.61	-	-	31
6. Instructional Methods	14	46.67	1	3.33	15	50.00	-	-	30
7.Learning Strategies	8	50.00	-	-	7	43.75	1	6.25	16
8.Active Learning	16	39.02	5	12.20	19	46.34	1	2.44	41
9. Measurement and Assessment	17	32.08	7	13.21	29	54.72	-	-	53
10. Instructional Planning	17	41.46	3	7.32	21	51.22	-	-	41
11. Classroom Management	2	40.00	-	-	2	40.00	1	2.44	5
TOTAL	141	40.87	27	7.83	165	47.83	12	3.48	345

RM: Replied Messages, CM: Composed Messages, Tot.: Total

As depicted in Table 2, in total 345 messages were sent concerning the course IPE and its 11 units during the asynchronous CMC for the whole term. Most messages were sent in the "Measurement and Assessment" unit, and the least in "Classroom Management".

As one can see in Table 2, the numbers of the replied and composed messages were separated. The moderator sent more messages (27 messages) as "compose message" then the students (12 messages). It means, most of the discussions were initiated by the moderator. Indeed, for seven units of the course (such as teaching process, instructional aims, etc.), the learners did not initiate any discussion, they just followed and participated in the moderator-initiated discussion topics. In addition, the moderator sent slightly fewer messages (141) then the students (165) as "replied messages". In total, the moderator sent 168 messages (48.70%) whereas all 14 learners sent 177 messages (51.30%).

4.3 Discussed Issues during Cmcs

What the participants discussed during asynchronous CMCs was considered another aspect of learner' interaction for knowledge construction. Discussion topics were themed and are given in Table 3 with the numbers of learners' and moderator's related messages.

Table 3. Discussed issues and participants' messages related to units of the course

Unit Num	Discussed Issues	Learners' Messages f			Mod's Messages f	
		RM to		CM	RM	CM
		L.	M.			
1	Teaching strategies	-	-	1	1	
	Student-centered instruction	2	1	1	1	
	The scope of learning to learn	1	2	7	10	1
2	Evaluation of the teaching processes of courses	3	8	-	6	1
	Bloom's model of learning in school	3	9	-	10	1
3	Developing examples of instructional aims	1	5	-	7	1
	Relationship between learning outcomes and instructional aims	-	4	-	2	1
4	The definition, usage and examples of advanced organizers	1	7	-	7	1
	Relationship between aim and content	-	6	-	6	1
5	Taking the individual differences into consideration	3	8	-	9	1
	Increasing the quality of teaching	2	3	-	4	1
6	Instructional methods and techniques used in different study fields	7	7	-	12	1
7	The features of individuals who have meta-cognitive knowledge	4	3	1	5	-
	Helping students develop their meta-cognitive knowledge	1	-	-	2	-
8	Active learning activities in classrooms	1	1	-	5	1
	Difficulties faced in active learning	1	2	-	2	1
	Relationships of the course related to active learning	-	2	-	2	1
	Enhancing the presentation method	1	6	-	7	1
9	Precautions for cheating on exams	3	8	-	7	1
	Errors made in multiple-choice exams	-	5	-	3	1
	Types of scales	1	2	-	2	1
	Test statistics	-	2	-	-	1
	Criteria based assessments	-	2	-	1	1
	Types of assessments	1	1	-	1	1

	Alternative approaches	-	2	-	1	1
10	Developing an example lesson plan	4	7	-	8	1
	Flexibility in plans	3	4	-	6	1
	Equality of opportunity in education through planning	-	3	-	2	1
11	Conflicts among students	2	-	1	2	-
Total		45	110	11	131	24

RM to L.: Learner's reply to other learner's message. RM to M.: Learner's reply to moderator's message. Mod's: Moderator's

As displayed in Table 3, various discussion topics were initiated for each unit. These results may explain the results on Table 2, as to why some of the units were not as popular as the others. For example, only one issue was discussed for the last unit whereas seven topics were initiated for the ninth unit of the course IPE.

According to Table 3, all discussion topics of units two, six, and 10 and a discussion topic (about individual differences and precautions for cheating in exams) of unit five and nine had more learner messages than the remaining ones. Besides, most of the learners' messages for these favorite discussion topics were reply messages to the moderator, except for the unit six, and all of these favorite topics, which have more messages, were initiated by the moderator. Interestingly, the discussion topic themed "the scope of learning to learn" of unit one was initiated by the moderator and the learners composed seven messages for this topic instead of replying to the moderators' discussion. This might be because of their enthusiasm to compose message during the first weeks of the course. Other four discussion topics which were initiated by the learners were not popular among them. Additionally, though the ninth unit seemed very popular at first glance with seven discussion topics, except for the first one, few messages were sent to other discussions for this unit.

4.4 Learners' Interactions in Terms of the Social Construction of Knowledge

Regarding learners' interaction, the social construction of knowledge was also questioned, and the results distilled from content analysis are presented in Table 4, only for five phases. The more detailed results of IAM according to operations of each phase were given on Appendix A.

Table 4. Frequencies of the phases in messages across the units

		Unit Numbers											Total	
Phase		1	2	3	4	5	6	7	8	9	10	11	f	%
Phase I	L	22	28	10	22	17	18	10	23	38	16	2	206	80.47
	M	20	34	11	17	13	14	9	23	27	12	3	183	82.81
Phase II	L	4	10	-	-	5	7	-	5	4	9	-	44	17.19
	M	-	-	4	2	5	2	-	5	2	8	-	28	12.67
Phase III	L	-	-	-	-	-	-	-	1	-	4	-	5	1.95
	M	-	-	-	1	-	2	-	2	-	4	-	9	4.07
Phase IV	L	-	-	-	-	-	-	-	-	-	1	-	1	.39
	M	-	-	-	-	-	-	-	-	-	1	-	1	.45
Phase V	L	-	-	-	-	-	-	-	-	-	-	-	0	0
	M	-	-	-	-	-	-	-	-	-	-	-	0	0
Phases in Total												*L*	*256*	*100*
												M	*221*	*100*

Phase I: Sharing/comparing of information; Phase II: The discovery and exploration of dissonance or inconsistency among ideas, concepts or statements; Phase III: Negotiation of meaning/co-construction of knowledge; Phase IV: Testing and modification of proposed synthesis or co-construction; Phase V: Agreement statement(s)/applications of newly-constructed meaning.

According to the results on Table 4, most of the learners' interactions were related with phase I, sharing-comparing of information. On the other hand, phase V, agreement statement(s)/applications of newly-constructed meaning, was never observed. The content of the moderator's messages was nearly the same as the content of the learners' messages with respect to the construction of new knowledge. Considering the units, mostly Phase I, "sharing and comparing information", was observed in learners' messages during the discussions for unit nine. Below is the example representing a learner's statement of her opinion and observation related to a discussion topic (precautions for cheating on exams):

Learner 10: "The best precaution we can take against cheating is to abolish the reasons that cause cheating and providing the students with an environment in which s/he trusts his/her knowledge more than his/her friends'. ... During primary education when they didn't even know what cheating meant, even if they didn't intend to cheat, the school bags put between the students made them think 'what can I see how can I see'." (Phase I/Operation A)]

On the other hand, unit 11 produced the lowest scores for phase I on behalf of both learners and the moderator. The quantitative results in Table 2 and 3 might explain why unit 11 was the least productive one for sharing and comparing information (Phase I): only one discussion topic might not have been appealing for the whole group and they might not have wanted to share their opinions and observations for the discussion topic.

Phase II, "the discovery and exploration of dissonance or inconsistency among ideas, concepts or statements", was observed mostly during the discussions under unit two and 10 for learners. For the first, fifth, sixth, eighth, and ninth units, there were few learner messages coded into phase II. For unit two, the moderator's informative messages might have lead the learners to query their background knowledge and, thus interact in a way to share dissonance of their previous knowledge. A learner's message from unit two representing an example for Phase II, Operation C, restating the participant's position, is as follows:

[Learner 4: "I think the phenomenon of mastery learning is not just about the educational strategy and aim-subject coherence. Internal and external factors are also in the loop…In my own way, I want to conclude that you can't teach a child who is hungry and cold with torn shoes that Mediterranean vegetation is macquis or should you teach?" (Phase II/Operation C)]

For unit 10, one discussion topic (developing an example of a lesson plan) worked as an assignment. The feedback and corrections of the learners to each other and those by the moderator to the learners' lesson plans might have led both the learners and the moderator to share dissonance amongst the ideas, and those statements were coded into phase II.

According to Table 4, Phase III, "negotiation of meaning/co-construction of knowledge", was observed a little more during the discussions for unit 10 for learners. The message below sent by a learner during the discussions for unit 10 was coded into two operations of phase III.

[Learner 1: "As far I as understand, everybody agrees o –to some extent flexibility." (Phase III/C) I think it is necessary to increase that 'extent'. ... If we are behind the already-made-plans because of some reasons, I say, let us plan basically and see how it goes in a flexible way." (Phase III/D)]

The above quotation was coded in Operation C, identification of areas of agreement or overlap among conflicting concepts, and Operation D, proposal or negotiation of new-statements of Phase III. Five messages of learners were coded in the operations of Phase III and only one learner message was coded into Phase IV as operation B, testing co-construction against existing cognitive schema.

5. Discussion and Conclusion

The current study focuses on the explicit participation and interaction of learners during asynchronous CMCs. The quality of learners' interactions during asynchronous CMC were investigated from more than one perspective to see the whole picture. The results were discussed with respect to Moore's three types of interactions and IAM.

Learner-content interaction during asynchronous CMCs was questioned with respect to what the learners discussed, or discussion topics. 29 different topics were themed through content analysis for the 11 units of the course IPE. All of these 29 topics of the study were directly related to the course content, and, as Rovai (2007) suggested, the moderator tried to direct learners to discuss real-life related topics. According to the learners' views, they generally liked the discussion topics, especially the real-life related ones. Actually, all the topics were related to real-classroom issues that an instructor would normally come across. Besides, as Lucas, Gunawardena and Moreira (2014) state, personal relevance to discussion topics might affect learners' motivation and engagement. Among the various topics, learners may find some topics more related to their background. Six

learners of the current study indicated that they found some topics more interesting.

Actually the main problem with 29 topics during a semester-long asynchronous CMC for 11 units is that most of the units had to be studied in a week. Furthermore, for some of the units such as unit nine "measurement and assessment", seven different topics were initiated though most of them did not really appeal to learners. One learner also pointed to this problem of discussing many topics in a week. On the other hand, when only one topic was initiated, again the discussion was limited. As a suggestion for future practice, the number of topics to be discussed in a week could be two or three for similarly structured graduate level online courses like IPE.

Apart from learner-content interaction, social interactions of learners with other learners and the moderator of the course are, as well, important opportunities of CMCs. According to the learners' views regarding their interaction with other learners in the present study, on the whole, it could be possible to claim that learner-learner interaction was at a moderate level. The quantitative results in Table 4 and 5 also support the views of the learners. When learners decided to participate in discussion, they mostly preferred to reply the moderator's messages. The fact that most of the learners did not know each other before the course can be a reason of this result. Though the moderator regularly reminded students about the importance of replying to other learners' messages, informed them about the expectations, and waited for a few days before replying a learner's comments, the learner-learner interaction did not occur at the higher levels. Helping learners produce their own web-pages by using related tools of the learning management system or providing a direct link to their pre-existing online profiles might also be useful for the future CMC practices in terms of increasing familiarity among the participants.

Various roles such as starter, summarizer, moderator, theoretician, and source searcher may be assigned to learners, as in De Wever et al. (2010), to enhance learner-learner interaction. However, in a study on student moderators, Zingaro (2012) found that students did not use various questions types. Gilbert and Dabbagh (2005) provide empirical evidence about the positive influence of adding facilitator guidelines on meaningful asynchronous online discussions. In future studies, specific roles might be assigned to learners following a training session on facilitating and additional guidelines for online discussions.

Besides learner-learner interactions, learner-moderator interaction is undeniably very important during knowledge construction processes since the expert of the subject is generally the instructor of the formal courses. The study of Hou et al. (2008) shows the importance of instructor's intervention in problem-based activities during asynchronous CMC. Besides, Arbough and Benbunan-Fich (2007) provide evidence about the significant positive effect of a high level of learner-instructor interaction on learning perception. Despite the importance of learner-moderator interaction, the moderator's *over-moderating* behavior might cause learner-learner interaction to fall behind the interaction with the moderator. The study of An, Shin and Lim (2009) also provides evidence for the negative effect of too much instructor intervention on learner-learner interaction. In the current study, when the learners participated in CMCs, they preferred mostly to reply to the moderator's messages although the moderator waited for few days for other learners to participate, and used probe questions instead of directly giving the answer. The moderator's presence might affect the learners' interactions as in the present study; however, "degree of intervention" is still vague and waiting to be answered. Another question which needs an answer is which one is better for the instructor's role; moderator and co-participant, or only the moderator? Even though the study of Lu and Jeng (2006) provides an answer to this question that being a facilitator and a co-participant is better than being only a facilitator, the degree of being co-participant might still be questioned in future studies.

While the results derived from the CMC records underlines the challenging position of the moderator, learners were very satisfied with the instructor's facilitating approach, taking feedback from the moderator, and sharing ideas, experiences, and academic information. Similarly, in Lu and Jeng's study (2006), learners' views about the instructor's role and facilitation are very positive though their postings are mostly (89.8%) coded into Phase I (in the current study it is 80.47%) of the IAM.

IAM helps researchers to understand the quality of interaction in terms of the level of knowledge construction during asynchronous online discussions. The results of the current study show that a high level of knowledge construction was not accomplished. As Gunawardena et al. (1997) state, the debate is a good example for construction of knowledge through social negotiation. In the case of the current study, asynchronous CMCs were not structured as debate. This might explain why the level of knowledge construction was mainly limited to Phase I and II. Gunawardena et al. (1997) also point out that in some cases where participants tend to accept other views and little conflict occurs between the ideas, all the five steps of social construction of knowledge do not always occur, and even the discussion might be limited around Phase I. When discussion topics of the

present study are considered, there is only one discussion topic under unit 10, "flexibility in plans", coded into Phase III in learners' messages. This topic might be much more controversial than the others. As a recommendation for future studies, if a debate is not organized, more controversial topics could be selected for discussions in order to enhance higher order thinking. Another reason of low level of knowledge construction during asynchronous CMC might be owned to the moderator's facilitating ability. However, how well Rovai's (1997) strategies were followed needs additional investigations.

Related literature provides similar evidence of low level of knowledge construction during CMCs (e.g., Lang, 2010; Lu & Jeng, 2006; Paulus, 2007; Quek, 2010; Tan et al., 2008). In their review study on IAM, Lucas et al. (2014) reviewed 16 studies conducted in higher education and post-graduation and used IAM. Among these studies, the results point out low level of knowledge construction mainly on Phase I, except for three studies. Hew and Cheung (2011) also underpin students' limited knowledge construction in asynchronous online discussions in many previous studies. Controversially, Heo et al. (2010) report that the messages of high performing teams in project-based learning reflect higher levels on knowledge construction. As a recommendation, designing learning environments that will include students into authentic learning process might help learners construct new-knowledge collaboratively.

Though the results of interaction analysis regarding knowledge construction in the study at hand point to low level of knowledge construction, the learners reported sharing knowledge and learning during asynchronous CMCs. This conflict between the results derived from learners' views and content analysis might be explained with vicarious interaction, which Gunawardena et al. (1998) describe as lurkers who are profiting from the conference without contributing actively. The learners who chose to stay as lurkers to read messages silently and not to explicitly participate in discussions, might have learned and constructed new knowledge. As a recommendation, all records of the learning management system might be examined to pinpoint who the lurkers are, and some kind of authentic assessment tools and techniques might be used to understand the level of individual knowledge construction.

The results of the investigation into the quality of learners' interactions in asynchronous CMC showed that while the learners' views and rough message numbers indicated almost high levels of interaction at first glance, identifying discussion topics with some quantitative results and analyzing the contents according to IAM suggest a more complicated picture. It is possible to conclude that both the quality and the quantity of learner-learner interaction was below the moderate level. Meanwhile, the quality and the quantity of learner-moderator and learner-content interactions were almost above the moderate level in the current study based on the results as a whole.

Acknowledgements

The author would like to thank to Dr. KıymetSelvi for her kindly permission to conduct this research in one of her online course groups, Dr. NihalTunca, Dr. RuhanKaradağ and Dr. LeventVural for their great effort for the reliability studies of the findings derived from the content analysis, and Dr. SerayTatli-Dalioğlu for the final proof-reading.

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Appendix A

Frequencies of the Operations for Each Phase in Messages across the Units

Phase			Unit Numbers											
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Sum**
PhI	A	L	11	13	4	12	6	7	6	13	23	4	-	**99**
		M	2	4	3	2	1	2	2	5	8	3	-	32
	B	L	3	4	-	2	1	4	-	4	3	4	1	**26**
		M	6	9	3	8	5	3	2	10	7	3	1	57
	C	L	3	5	6	7	7	5	4	5	5	7	-	**54**
		M	-	1	-	2	-	-	-	3	1	1	-	8
	D	L	3	5	-	1	2	2	-	1	7	1	-	**22**
		M	7	17	3	5	5	9	5	2	5	4	2	64
	E	L	2	1	-	-	1	-	-	-	-	-	1	**5**
		M	5	3	2	-	2	-	-	3	6	1	-	22
PhII	A	L	1	4	-	-	1	2	-	2	2	4	-	**16**
		M	-	-	3	1	1	1	-	1	-	2	-	9
	B	L	2	1	-	-	-	2	-	-	-	3	-	**8**
		M	-	-	1	-	-	1	-	3	1	2	-	8
	C	L	1	5	-	-	4	3	-	3	2	2	-	**20**
		M	-	-	-	1	4	-	-	1	1	4	-	11
PhIII	A	L	-	-	-	-	-	-	-	-	-	-	-	**0**
		M	-	-	-	1	-	-	-	-	-	3	-	4
	B	L	-	-	-	-	-	-	-	-	-	1	-	**1**
		M	-	-	-	-	-	-	-	-	-	-	-	0
	C	L	-	-	-	-	-	-	-	-	-	2	-	**2**
		M	-	-	-	-	-	-	-	-	-	1	-	1
	D	L	-	-	-	-	-	-	-	1	-	1	-	**2**
		M	-	-	-	-	-	2	-	2	-	-	-	4
PhIV	B	L	-	-	-	-	-	-	-	-	-	1	-	**1**
		M	-	-	-	-	-	-	-	-	-	1	-	1