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Analyzing Online Learners' Knowledge Construction in Asynchronous Discussion Forums Using Interaction Analysis Model

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Abstract: For the past decades, interest in research studies focusing on how interaction and learning take place, and how computer-mediated asynchronous tools such as Asynchronous Discussion Forum (ADF) opens opportunities for online learners to collaborate and construct knowledge, has elevated among online learning advocates and practitioners. Related literature on knowledge construction in discussion forums is now seen as an essential part of the teaching and learning process in an online learning environment. As we move from traditional to virtual classrooms, the need to look into models and approaches to analyze knowledge construction in discussion forums, especially in the Philippine setting where it is relatively very scarce or not investigated at all, is inevitable to have a deeper understanding of student participation in an online learning setting. By employing a content analysis using the Interaction Analysis Model (IAM), this study uncovered what level of the social construction of knowledge was reached in the discussion forums of the online graduate colloquium. In addition, this study also looks at the factors that might be attributed to the patterns of how knowledge is constructed in the discussion forums in an online learning environment. This study emphasizes the potential of providing more opportunities for online learners to create knowledge by empowering students through the creation of a learning environment that encourages interactions and collaborations among themselves. The results of this study will hopefully contribute to the studies on methodologies and approaches to explore online interactions focusing on knowledge construction in discussion forums in an online learning environment.

Keywords: knowledge construction, asynchronous discussion forum (ADF), online learning, Interaction Analysis Model (IAM)

INTRODUCTION

The advent of computer-mediated communication (CMC) introduces new perspectives on how social interaction and learning takes place in an online learning environment as it supports a space which opens opportunities for online learners to collaborate and construct knowledge. The growth of online learning environments entails an understanding of how to promote collaborative knowledge construction processes and create learning environments that support meaningful student engagement and interactions (Galikyan & Admiraal, 2019). More than simply a common meeting place, an online learning community allows for the mutual exploration of ideas, a safe place to reflect and develop those ideas, and a collaborative, supportive approach to academic work (Palloff & Pratt, 2007).

The exchange of messages among a group of participants using networked computers, to discuss a topic of mutual interest, is referred to as computer-mediated conferencing or computer conferencing (Gunawardena et al., 1997). Of all networking media available to educators in the 1980s and 1990s, conferencing systems were the most amenable to instructional design and can be thought of as "spaces" that can be shaped to create an educational forum (Harasim, 2000). Contemporary educators who view learning as interactive, discursive, and situated have argued that well-designed online conferencing environments may be particularly suited to provide the socio-cognitive support for learning seen as fundamental to constructivist pedagogies (Lapadat, 2002).

The pedagogy supporting the use of asynchronous communication tools within learning communities has its roots in constructivism and social constructivism where interactions provide an opportunity for learners to create their understanding by communicating with others and collaborate by sharing experiences and information in a way that promotes critical thinking and knowledge construction (Corich et al., 2007). Unlike the traditional classroom activity,

in which the teachers direct the instruction, lead the lessons, prompt responses, and pace the class, online group learning is student-centered and requires a different role for the teacher as a facilitator rather than a lecturer (Harasim et al., 1995).

The social construction of knowledge is a phenomenon defined by Gunawardena (1997) as a function of interaction, which is understood as a reciprocal influence among individuals that engage in dialogue (Gomez, 2018). Social constructivist pedagogy acknowledges the social nature of knowledge and its creation in the minds of individual learners, and each learner constructs means by which new knowledge is both created and integrated with existing knowledge (Anderson & Dron, 2011). According to constructivist learning theories, how we construct knowledge will depend on what is already known, and what we know depends on the kinds of experiences that we have had and how we have come to organize these into existing knowledge structures (Kanuka & Anderson, 1998). Social constructivism is currently the most accepted epistemological position associated with online learning and in this view, the assumption is that knowledge is grounded in the relationship between the knower and the known and that knowledge is generated through social intercourse, and through this interaction, we gradually accumulate advances in our levels of knowing (Kanuka & Anderson, 1998). The value of another person's perspective, usually gained through interaction, is a key learning component in constructivist learning theories, and inducing mindfulness in learners' interaction has always been valued in distance education, even in its most traditional, independent study format (Jonassen, 1994; Anderson, 2004). Works on collaborative learning are said to illustrate potential gains in cognitive learning tasks, as well as increases in completion rates and the acquisition of critical social skills in education (Anderson, 2004). Modern constructivist theorists stressed that the learner-to-learner interaction, an inter-learner interaction, between one learner and other learners, alone or in group settings, with or without the real-time presence of an instructor, is an essential and extremely valuable resource for learning and in investigating and developing multiple perspectives (Anderson, 2004; Moore, 1989).

Computer conferencing systems such as discussion forums have become a primary focus of educational research in recent years because of their capabilities that allow students to develop basic skills within authentic contexts that also promote meaningful and collaborative learning (Pena-Shaff & Nicholls, 2004). In an online learning environment, a computer-mediated conference like an asynchronous discussion forum (ADF) is seen as the "heart and soul" of online education and one of the most powerful tools for creating online learning communities because of its potential to support a learning environment where learners actively interact and construct knowledge (Corich et al., 2007; Jonassen, 1994; Harasim, 2000). In online classrooms that seek to facilitate knowledge construction, ADF is the most common space in which this collaborative knowledge and meaning are actively constructed, and the members of the community enhance the acquisition of knowledge and understanding and thereby satisfying learning needs (Hall, 2010; Rigou, 2004).

Asynchronous communication tools such as ADFs offer new possibilities for a study that was not available in traditional learning models, making the process of collaboration more transparent by looking at the transcripts of forums which can be used to assess individual roles and contributions and the collaborative process itself (Aviv et al., 2010). ADFs seem a remarkable fit for constructivist and collaborative approaches to learning as it not only allows students and teachers to interact with each other, permitting both parties to shape the nature of the exchange but also prompt students to review posted information and analyze their ideas before responding because they are not constrained to respond immediately (Pena-Shaff & Nicholls, 2004). The opportunity for asynchronous interaction facilitates communication across time zones and increases control by the user over time and pace of participation, providing participants the opportunity to comment immediately or to reflect and compose a response thoughtfully, leading students to their potential to strengthen writing skills and encourage more deliberate articulation of ideas. (Harasim et al., 1995; Pena-Shaff & Nicholls, 2004).

In an online learning environment, ADFs provide potential convenience by allowing students to interact with each other and with the instructor when and where they want, and even to control the pacing of instruction, without the direct stimulation of real-time interaction (Bento & Schuster, 2003). The asynchronicity of online interaction allows participants time to reflect on a topic before commenting or carrying out outline tasks (Harasim et al., 1995). The distance-and-time-independent nature of online asynchronous discussion forums provides students more time to look into posts made by themselves and others and more opportunities to respond to others' messages at their own pace, if and how they choose to.

ADFs which are intended to support knowledge construction and higher-order thinking is becoming even more appealing for their predictive relationship with learning (Galikyan & Admiraal, 2019). Online forums provide the potential for new forms of collaborative work, study, and community that reduce barriers of time and distance and

their asynchronous qualities increase access and expand opportunities for discussion, interaction, and reflection (Kanuka & Anderson, 1998; Harasim, 2000). In discussion forums (DFs), critical thinking is evident when participants construct meaning while communicating with fellow participants, and when used appropriately, DFs can enable rapid dissemination of information and can encourage feedback and the refinement of ideas among participants (Corich et al., 2007). Citing Lamy & Goodfellow (1999), Corich et al. (2007) also mentioned that educational researchers have also reported positive outcomes using threaded discussions that encourage students to accept responsibility for building knowledge by reflecting on course materials and discussing content with fellow participants.

For the past decades, interest in research studies focusing on how interaction and learning take place, and how computer-mediated asynchronous tools such as ADFs open opportunities for online learners to collaborate and construct knowledge, has elevated among online learning advocates and practitioners. As we move from traditional to virtual classrooms, the challenge of understanding and nurturing student participation in class discussions is being considered not just something "nice to have," but an essential part of the teaching and learning process in a student-centered and constructivist approach to education where control shifts from the teacher to the learner (Anderson & Garrison, 1998; Bento & Schuster, 2003; Corich et al., 2007).

Several research studies argued that the level of learners' interaction affects the quality of learning and the learning process itself, thus making it an important factor in the success of online learning and teaching (Anderson & Garrison, 1998; Kanuka & Anderson, 1998; Aviv et al., 2010; Bento & Schuster, 2003; Corich et al., 2007; Durairaj & Umar, 2015; Garrison & Anderson, 2003; Power & St-Jacques, 2014). Research studies revealed that the level of student interaction is found to be important in learning because the interaction affects the quality of learning and it will affect the learning process as well (Durairaj & Umar, 2015; Garrison & Anderson, 2003). While studies employing the advances of the Interaction Analysis Model to determine the level of knowledge construction in discussion forums are recently getting interested among online learning advocates and practitioners as well (Durairaj & Umar, 2015; Gomez, 2018; Gunawardena et al., 2016; Gunawardena et al., 2014; Gunawardena et al., 1997; Hall, 2010; Heo, et al.,2010).

In an online learning setting which typically uses a learning management system (LMS) such as Moodle which serves as the online classroom where students and teachers meet and conduct classes, an asynchronous discussion forum (ADF) offered learners the opportunity to exchange their experience through interaction in a forum, promote learning through intellectual stimulation and the exchange of ideas as learners react to the course reading, and even give comments on the viewpoints of their peers on the topics discussed in the course (Dooga, 2010, as cited by Roseli & Umar, 2015; Galikyan & Admiraal, 2019). Related literature on knowledge construction in discussion forums is now seen as an essential part of the teaching and learning process in an online learning environment. As we move from traditional to virtual classrooms, the need to look into models and approaches on how to analyze knowledge construction in discussion forums, especially in the Philippine setting where it is relatively very scarce or not investigated at all, is inevitable to have a deeper understanding of student participation in an online learning setting.

This study aims to determine if knowledge construction is present in the discussion forums by analyzing the transcripts of communication exchanges of online students in an Open University in the Philippines. By employing a content analysis using the Interaction Analysis Model (IAM), this study hopes to uncover what level of the social construction of knowledge was reached in the discussion forums of the online graduate colloquium. In addition, this study will also look at the factors that might be attributed to the patterns of how knowledge is constructed in the discussion forums in an online learning environment. The results of this study will hopefully contribute to the studies on methodologies and approaches to explore online interactions focusing on knowledge construction in discussion forums in an online learning environment.

RESEARCH DESIGN & METHODS

Unit of Analysis

This study utilized the transcripts of communication exchanges of nine graduate students who participated in the discussion forums of an online graduate colloquium as part of their class requirements in a graduate program. The data was extracted from an anonymized copy of GradCourse01, an online graduate class using Moodle upon obtaining the necessary permission and ethical review requirements. Moodle or Modular Object-Oriented Dynamic Learning Environment is an open-source learning management system (LMS). GradCourse01 contains discussion forums that are learner-managed.

In this course, each student is assigned a colloquium block where he or she will select a specific seminar topic that focuses on research tools, research methods, research approaches, research issues, and practices that are relevant to and use in researching communication phenomena. Each student is required to present, manage, and moderate a colloquium for one week. Non-presenters, on the other hand, are encouraged and expected to actively participate in all colloquium sessions.

The transcripts that were extracted from GradCourse01 contained a total of 732 posts from nine (9) discussion forums (see Table 1). To preserve the anonymity, privacy, and confidentiality of the participants in this study, the names of participants and course names were anonymized and replaced with codes (ex. A1 for Student 1, GradCourse01 for the course name) in the data collection, data analysis, and dissemination and reporting of the study findings.

Data Collection

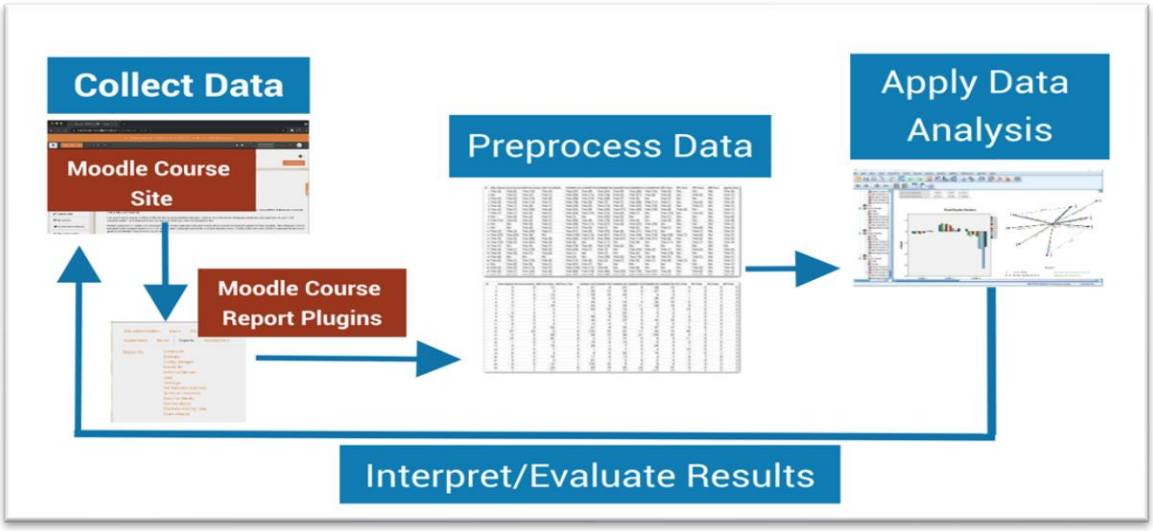

Figure 1. Process of Data Mining in Moodle Course Site Using Standard Report Plugins in Moodle

This study adapted the process in data mining by Romero, et al. (2007) (see Fig.1) as a tool for data collection. Transcripts of messages and log records of students' activities including forum posts were extracted from nine asynchronous discussion forums in an online graduate course. The online course is a student-managed/driven course that focuses on research tools, methods, approaches, issues, and practices. Data were generated using selected standard report plugins for Moodle and were cleaned and preprocessed using Microsoft Excel and Google Sheets (see Fig. 2). Extracted data used in this study includes transcripts from nine discussion forums containing posts contributed and log records of students' activities.

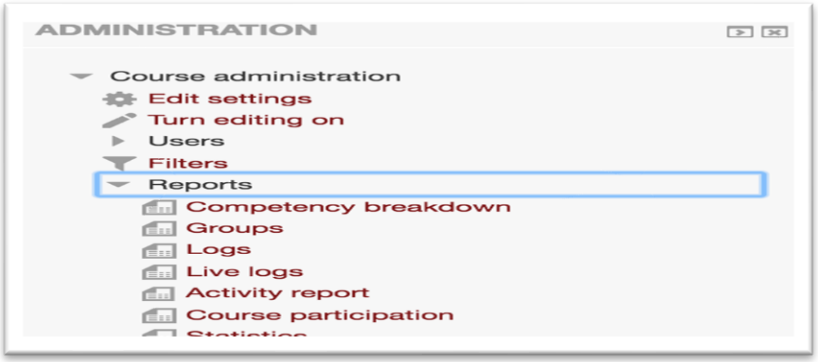

*Figure 2. S*creenshot of the standard report plugin in the Moodle course site

Data Analysis

Content analysis, using the five-phase Interaction Analysis Model (IAM) by Gunawardena et al. (1997) (Phase I. Sharing/comparing of information, Phase II. Discovery and exploration of dissonance or inconsistency among the ideas, concepts, or statements advanced by different participants, Phase III. Negotiation of meaning and/or co-construction of knowledge, Phase IV. Testing and modification of proposed synthesis or co-construction and Phase V. Phrasing of agreement, statement(s), and applications of the newly constructed meaning) was used in this study to identify the level of knowledge construction that occurred in the online discussion forums using the transcripts that were extracted from the learning management system (see Fig.3).

PHASE I: SHARING/COMPARING OF INFORMATION. Stage one operations include:

A. A statement of observation or opinion	[PhI/A]
B. A statement of agreement from one or more other participants	[PhI/B]
C. Corroborating examples provided by one or more participants	[PhI/C]
D. Asking and answering questions to clarify details of statements	[PhI/D]
E. Definition, description, or identification of a problem	[PhI/E]

PHASE II: THE DISCOVERY AND EXPLORATION OF DISSONANCE OR INCONSISTENCY AMONG IDEAS, CONCEPTS OR STATEMENTS. (This is the operation at the group level of what Festinger [20] calls cognitive dissonance, defined as an inconsistency between a new observation and the learner's existing framework of knowledge and thinking skills.) Operations which occur at this stage include:

A. Identifying and stating areas of disagreement	[PhII/A]
B. Asking and answering questions to clarify the source and extent of disagreement	[PhII/B]
C. Restating the participant's position, and possibly advancing arguments or considerations in its support by references to the participant's experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point of view	[PhII/C]

PHASE III: NEGOTIATION OF MEANING/CO-CONSTRUCTION OF KNOWLEDGE

A. Negotiation or clarification of the meaning of terms	[PhIII/A]
B. Negotiation of the relative weight to be assigned to types of argument	[PhIII/B]
C. Identification of areas of agreement or overlap among conflicting concepts	[PhIII/C]
D. Proposal and negotiation of new statements embodying compromise, co-construction	[PhIII/D]
E. Proposal of integrating or accommodating metaphors or analogies	[PhIII/E]

PHASE IV: TESTING AND MODIFICATION OF PROPOSED SYNTHESIS OR CO-CONSTRUCTION

A. Testing the proposed synthesis against "received fact" as shared by the participants and/or their culture	[PhIV/A]
B. Testing against existing cognitive schema	[PhIV/B]
C. Testing against personal experience	[PhIV/C]
D. Testing against formal data collected	[PhIV/D]
E. Testing against contradictory testimony in the literature	[PhIV/E]

PHASE V: AGREEMENT STATEMENT(S)/APPLICATIONS OF NEWLY-CONSTRUCTED MEANING

A. Summarization of agreement(s)	[PhV/A]
B. Applications of new knowledge	[PhV/B]
C. Metacognitive statements by the participants illustrating their understanding that their knowledge or ways of thinking (cognitive schema) have changed as a result of the conference interaction	[PhV/C]

Figure 3. Interaction Analysis Model (IAM) (Gunawardena et al., 1997)

Extracted transcripts were processed and saved as code sheets using Excel and Google Sheets. Created code sheets for the posts contributed including information such as username, message, date created, forum number, and IAM phase number (see Fig.4). Each message/post contributed was chosen as the unit of analysis for the coding and evaluation of the level of knowledge construction. Messages in the code sheets were analyzed using Interaction Analysis Model (IAM) (Gunawardena et al., 1997) to identify the level of knowledge construction that occurred in the online discussion forums.

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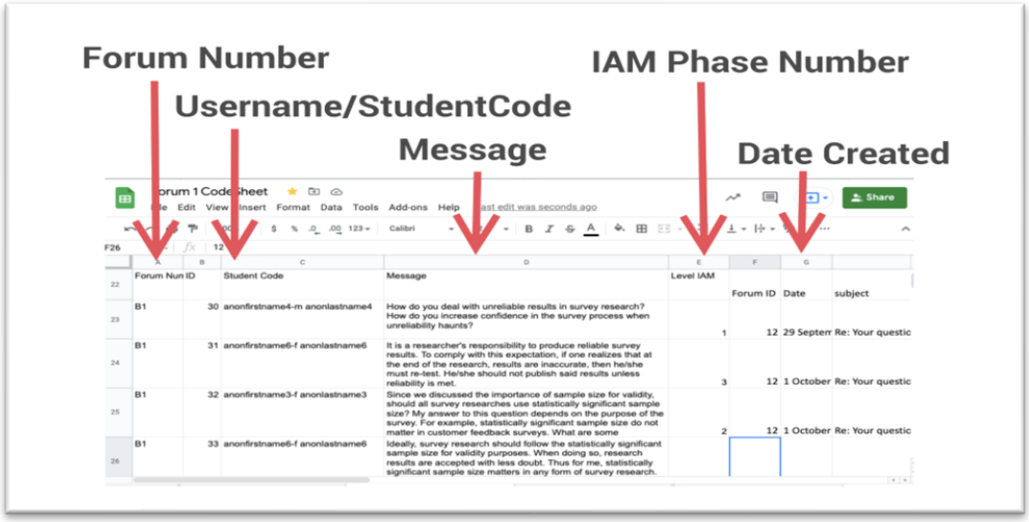

Figure 4. Screenshot of Forum Transcripts Code Sheet

RESULTS

Frequency of Posts in the Discussion Forum

A total of 732 posts in the discussion forums were extracted from the course. Out of nine DFs, results showed that most of the messages were posted under DF 5 (15.85%), DF 4 (13.25%), and DF 1 (12.02%), while only 6.56% of the messages were posted under DF 2 (see Table 1).

Table 1

Number of Posts of Students per Discussion Forum

Discussion Forum (DF)	# of Posts	%
DF 1	88	12.02%
DF 2	48	6.56%
DF 3	81	11.07%
DF 4	97	13.25%
DF 5	116	15.85%
DF 6	74	10.11%
DF 7	80	10.93%
DF 8	76	10.38%
DF 9	72	9.84%
TOTAL	732	100.00%

Level of Knowledge Construction Reached in the Discussion Forums

To identify the level of knowledge construction that occurred in the online discussion forums, content analysis, using the five-phase Interaction Analysis Model (IAM) by Gunawardena et al. (1997) was used in this study.

From the total of 732 messages from nine discussion forums extracted for this study, results showed that different levels of knowledge construction are present in all the DFs. Most of the messages (78.96%) in the DFs were coded under Phase I (Sharing/comparing of information) of the social construction of knowledge, while less than one

percent (0.27%) were coded under Phase II (Discovery and exploration of dissonance or inconsistency among the ideas, concepts, or statements advanced by different participants). Some of the messages (20.77%) in the DFs were coded under Phase III (Negotiation of meaning and/or co-construction of knowledge) (see Table 2).

Table 2

Level of Knowledge Construction Reached in GradCourse01

Phase/Level	Frequency	Percentage
I	578	78.96%
II	2	0.27%
III	152	20.77%
IV	0	0.00%
V	0	0.00%
Total	732	100.00%

Results showed that in DF 1, knowledge construction in Level I (68.18%), Level II (2.27%), and Level III (29.55%) were reached. All of the messages in the discussion Forum 2 and Forum 7 are coded under Phase I (Sharing/comparing of information) of the social construction of knowledge (Table 2).

More than half of the messages in Forum 1 (68.18%), Forum 4 (56.7%), and Forum 6 (59.46%) were coded under Phase I (Sharing/comparing information) of the social construction of knowledge (see Table 3). Most of the messages in Forum 3 (82.72%), Forum 5 (74.14%), Forum 8 (93.42%), and Forum 9 (93.06%) were also in Phase I (Sharing/comparing of information) of the social construction of knowledge (see Table 3).

This implies that the students' interactions in the forums are mostly statements on sharing and comparing information.

Table 3

Level of Knowledge Construction Reached per Discussion Forum

PHASE/ LEVEL	FORUM 1 (n=88)	FORUM 2 (n=48)	FORUM 3 (n=81)	FORUM 4 (n=97)	FORUM 5 (n=116)	FORUM 6 (n=74)	FORUM 7 (n=80)	FORUM 8 (n=76)	FORUM 9 (n=72)
I	68.18%	100.00%	82.72%	56.70%	74.14%	59.46%	100.00%	93.42%	93.06%
II	2.27%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
III	29.55%	0.00%	17.28%	43.30%	25.86%	40.54%	0.00%	6.58%	6.94%
IV	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
V	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

DISCUSSION

The messages in the discussion forums that were coded under Phase I of the social construction of knowledge vary from statements of observation or opinion or statements of agreement from one or more participants ("I agree with your idea that...", "I think", "In my opinion...", "I believe that...", "You are right..."), while some are definitions, descriptions, or identification of a problem. Some statements in the discussion forums were to ask or answer questions to clarify details of statements ("Please enlighten me about how you plan to use…", "I wonder how you will approach…?", "Do you plan on using Context Analysis…?", "Please let me clarify..."). While some statements corroborated examples provided by other participants ("I would like to base this post on my experience...").

Some factors that might be attributed to why the messages in the discussion forums of this online course were mostly coded on Phase I of the social construction of knowledge include how the forums were designed, the intention of the moderator, and the discussion points made by the moderators. Discussion forums that were created in this online course were designed as a learner-managed colloquium on communication research where students were expected to share a specific seminar topic that he/she plans to implement as his/her dissertation. Moderators of the discussion forums intended to share their research plans and how they are going to implement them, while other students were expected to give their opinions and share ideas that they think can help in the implementation of the research. Discussion points such as "What do you think is the importance of...", "What are your recommendations...", "I would like you to share…", "You can comment..." might lead other participants to comment or share their opinions and personal experiences regarding the topic, thus limiting students' interactions to statements of observation, opinion or agreement on the discussion topics. This result supports the findings of Wang et al. (2009) that the nature of discussion topics greatly influenced the depth of online discussions and knowledge construction and that topics selected for online discussions should be meaningful and relevant to participants and challenging and controversial enough to trigger different opinions.

While most of the messages are coded in Phase I of the social construction of knowledge, only less than one percent of the messages are recorded in Phase II, the discussions on the discovery and exploration of dissonance or inconsistency among ideas, concepts, or statements (Table 2). This suggests that most of the students in this class were not keen on identifying or stating areas of disagreement with other students' statements. Out of nine discussion forums, only Forum 1 contains messages that identify and state areas of disagreement or dissonance. Statements such as "However, I see a loophole because, as researchers, we actually cannot identify..." and "Thank you for pointing out other factors that may affect ….however, what we wanted to establish in the discussion thread is….". This could also be because discussion forums did not specifically call for participants to post diverse or opposing views on the topic, which was also noted by Gunawardena, et al. (2014) in their study. Another aspect that can be considered as to why there is a very small number of interactions under Phase II of the social construction of knowledge can be considered based on the idea suggested by Gunawardena, et al. (2014) as observed by some researchers that discussion of dissonance or opposing ideas online may not be culturally appropriate- that non-native speakers, particularly students from Asian countries, consider it far less appropriate to challenge and criticize the ideas of others.

Despite the very small percentage of discussions on Phase II, it is quite interesting to note that the occurrence of discussions coded on negotiations of meaning or co-construction of knowledge (Phase III of the social construction of knowledge) were still observed in Forum 1 (29.55%), Forum 3 (17.28%), Forum 5 (25.86), Forum 8 (6.58%), and Forum 9 (6.94%), and almost half of the messages in two discussion forums Forum 4 (43.30%), Forum 6 (40.54%) (Table 3).

The absence of messages under Phase IV and V of the social construction of knowledge were observed in all discussion forums. This suggests that students in this class were not able to reach the level where they test and modify the proposed synthesis or to agree and apply newly constructed meaning. This might be explained by the fact that at this stage, students are still in the planning stage of their research, and they were given a limited time (only one week per discussion forum) to continuously interact with each other until they reach a higher level of knowledge construction. Another factor that can be considered is the level of the student's motivation to engage. As suggested by Gunawardena et al. (2014), the personal relevance of discussion topics may influence participants' motivation and engagement; motivated and engaged participants are more likely to employ deep, reflective strategies, weigh and compare ideas or arguments and change their cognitive schema. The discussion points provided by the moderators can also be attributed to the level of engagement and motivation to construct knowledge among the participants.

CONCLUSION

To identify the level of knowledge construction that occurred in the online discussion forums, transcripts that were extracted from the learning management system were evaluated using the five-phase Interaction Analysis Model (IAM) by Gunawardena et al. (1997) (Phase I. Sharing/comparing of information, Phase II. Discovery and exploration of dissonance or inconsistency among the ideas, concepts, or statements advanced by different participants, Phase III. Negotiation of meaning and/or co-construction of knowledge, Phase IV. Testing and modification of proposed synthesis or co-construction and Phase V. Phrasing of agreement, statement(s), and applications of the newly constructed meaning).

The result shows that most of the messages in the nine discussion forums are coded under Phase I (78.96%), less than one percent under Phase II (0.27%), and 20.77% under Phase III, while the occurrence of messages under Phase IV and V are not present in all discussion forums (Table 2).

This study suggests some factors on why, based on the results, most of the messages in the nine discussion forums were coded under Phase I or the Sharing/comparing of information level. Some factors identified were: 1) how the forums were designed, 2) the intention of the moderator, and 3) discussion points made by the moderators. The online course in this study was designed where moderators of the discussion forums were expected to share their research plans and how they are going to implement their research, while other students were encouraged to give their opinions and share ideas that they think can help in the implementation of the research. This study also suggests that the discussion points such as "What do you think is the importance of...", "What are your recommendations...", "I would like you to share…", and "You can comment..." might have led other participants to give statements and comment or share their opinions and personal experiences regarding the topic, thus limiting students to give statements of observation, opinion or agreement on the discussion topics.

The small percentage of the messages are recorded in Phase II, the discussions on discovery and exploration of dissonance or inconsistency among ideas, concepts, or statements suggest that most of the students in this class were not keen on identifying or stating areas of disagreement on other students' statements. One factor that can be considered to explain the result is that the design of the discussion forums in this study did not intentionally encourage participants to freely post appropriate diverse or opposing views in the discussion forums as part of their collaborative learning. Another factor that can be considered is the observation from other research studies that discussion of dissonance or opposing ideas online may not be culturally appropriate, particularly for students from Asian countries which is far less appropriate to challenge and criticize the ideas of others (Gunawardena, et al., 2014). Although this reason has yet to be determined applicable in the current study, perhaps by asking directly the participants in future research.

The absence of messages under Phase IV and V in all discussion forums indicate that students in this class were not able to reach the level where they test and modify the proposed synthesis or to agree and apply newly constructed meaning. A possible explanation for this is that, at this stage, students are still in the planning stage of their research, and they were given a limited time (only one week per discussion forum) to continuously interact with each other until they reach a higher level of knowledge construction. Another factor that can be considered is the lack of student motivation to engage which can also be associated with how the discussions were moderated.

This study emphasizes the potential of providing more opportunities for online learners to create knowledge by empowering students through the creation of a learning environment that encourages interactions and collaborations among themselves. Thus, the researcher recommends online teachers and practitioners put into consideration the following factors in creating their discussion forums: 1) how the forums were designed, 2) the intention of the moderator, and 3) the discussion points made by the moderators.

As learning occurs through the creation of networks (Siemens, 2007), it is also recommended that both student-to-student and moderator-to-student (or student-to-moderator) interactions are encouraged in the discussion forums to widen their potential to create knowledge through interactions and collaborations with other students. It would also be helpful to consider the factors indicated in this study why the students interacted with each other, aside from interacting with the moderator as a guide in designing an online learning environment.

Results of the study recorded a very small percentage of the messages in Phase II, the discussions on discovery and exploration of dissonance or inconsistency among ideas, concepts, or statements, implying that most of the students in this class were not keen on identifying or stating areas of disagreement on other students' statements. However, Siemens (2004) suggested that dissonance may contribute to knowledge construction as learning and knowledge rests on a diversity of opinions.

Thus, it would be noteworthy to consider incorporating in the designs of discussion forums a learning environment where students can freely express their disagreements with the intention of collaborative learning. It might also help if explanations of the objectives of the encouragement for healthy and productive disagreements are intentionally indicated and incorporated in the course guidelines, so students are informed at the start of the class.

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