A proposed conceptual framework in measuring social interaction and knowledge construction level in asynchronous forum among university students

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Abstract

This paper presents a conceptual framework of a study that aims to measure students’ social interaction and knowledge construction in an asynchronous online forum. In order to acquire meaningful learning through online forum, the proposed framework is grounded on three theories, namely social constructivism, theory of online learning and connectivism theory. In addition, a combination of multi analysis techniques in analyzing the forum messages was proposed, which include content analysis, cluster analysis and social network analysis. This study intends to elucidate the proposed conceptual framework with particular emphasis on the advantages of applying each method of analysis.

Keywords: Asynchronous Forum; Content Analysis; Cluster Analysis; Social Network Analysis; Social Constructivism, Theory of Online Learning; Connectivism Theory

1. Introduction

One of the most widely used asynchronous communication tools in online courses is discussion forums. Discussion forum can improve students’ understanding (Balaji & Chakrabarti, 2010) and also increase students’ grades (Khoshneshin, 2011). Even so, past studies showed the students’ interaction level is still low, and forum is still not popular (Wise, Speer, Marbouti & Hsiao, 2012). To create quality interactive discussion, the students should read the existing messages in the forum before posting their messages (Wise, et al., 2012a). However, they are lack of knowledge to apply the proper procedures for sending messages in the forum. For instance, most students focused on selected forums only (Peters & Hewitt, 2010), resulting a deviation from the topic being discussed (Hou, Chang, Sung, 2007). There are also students who just read the messages and do not take part in the forum. In addition, a
high level involvement by the instructor may reduce the students’ interaction level as they feel less confident in stating their ideas (An, Shin, & Lim, 2009). Based on the existing literature, the authors aimed to develop a conceptual framework that highlights these problems as well as to propose ways to improve the students’ interaction level and knowledge construction in online discussion forum.

2. Analysis

A combination of different methods of analysis is valuable as each analysis could provide different information on the subjects. Moreover, each approach has its own limitations which can be compensated for by using an alternative method in order to collect comprehensive findings. Therefore, this paper attempts to explore the advantages of combining three types of analysis in asynchronous forum.

2.1. Content analysis

Content analysis is an effective technique for researchers to get a better understanding of the cognitive processes and the quality of online learning (Gunawardena, Lowe & Anderson, 1997). Although there are many models of content analysis, this study recommends the use of Interaction Analysis Model (IAM) by Gunawardena, et al., (1997). As this study is focusing on the participants’ knowledge construction in an online forum, the IAM model is favorable to be used in collaborative and constructivist learning environment. According to Gunawardena, et al., (1997), the knowledge construction process involves several phases starting from a lower level to higher level comprises of (a) sharing/comparing information (phase 1), (b) exploration of dissonance (phase 2), (c) knowledge co-construction (phase 3), (d) testing/modification of co-construction (phase 4), and (e) agreement/application (phase 5). The IAM was developed to measure the quality rather than the quantity of interaction to determine students' involvement to change the understanding of the individual or to generate new knowledge (Gunawardena, et al., 1997).

2.2. Cluster analysis (listening behavior)

Listening behavior consists of when and how students interact in discussion forum (Wise, et al., 2012). Expressing opinions or contribution in online discussions is conceptualized as speaking while listening consists of reading the opinions and ideas from peers (Wise, Speer, Marbouti & Hsiao, 2011). Students’ action or task with existing post in the online discussion is considered as their engagement in the forums. Listening behavior patterns can be classified according to six domains, namely, temporality, breadth, depth, speaking, reflection and final grade with 13 variables (Wise, 2012). This study employs Wise’s taxonomy involving four specific domains (temporality, breadth, depth, and speaking) and ten variables. Reflection domain is excluded in this study due to the limitation of the system used, while the final grade was also excluded due to the confidentiality of the students’ grades.

Temporality domain involves four variables: average length of session, percentage of sessions with posting actions, average number of sessions per discussion and average number of reads before contributing a post. The breadth domain involves two variables: percentage of posts viewed at least ones and average number of views per discussion. The depth domain consists of one variable, i.e., the average length of time reading a post. Lastly, speaking domain involves three variables: the average number of posts contributed per discussion, average number of words per post and average length of time creating a post served. Cluster analysis was applied to determine the patterns of online listening behavior for every student according to their level of interaction in asynchronous discussion forums. The outcome of this analysis will suggest clusters with several patterns of listening behaviors among the participants in the online forum.
2.3. Social network analysis

According to Vercellone-Smith, Jablokow and Friedel (2012), Social Network Analysis (SNA) is a tool that can be used to assess the overall pattern of social interaction and information exchange that takes place in the overall discussion forum. Besides that, it could identify at-risk students in the class (MacFadyen & Dawson, 2010), and provide a visual representation of students’ learning task (Dawson, Bakaria, Heathcote, 2010). Social network analysis can provide visual information such as strong or weak ties in the network. This will provide us with the information about potential high achievers or low-performing students in the class. An early identification of these students will allow the instructor to further encourage or to find a solution to help these students.

Betweenness centrality, closeness centrality, degree centrality and density are the variables used in SNA to analyze the social level of interaction among students in the online forum (Vercellone-Smith, et al., 2012). In SNA, the participants are ‘nodes’ and the connections (links) among the nodes pictured with arrowed lines. SNA can identify the participants in the network and the role played by them with regard to the degree centrality, closeness centrality, and betweenness centrality. These measurements provide the individuals’ behavior information in the network, for instance; (a) a measure of distance from other participants (closeness centrality), (b) have more direct contact with other participants (degree centrality), or (c) found in a rewarding position, between other participants (betweenness centrality) (Hanneman, 2001). To gain this information, a software known as SNAPP developed by Dawson, et al., (2010), can be utilized.

In this paper, SNA will be used to analyze students’ engagement and social level of interaction in asynchronous discussion forums by categorizing them accordingly as active or passive participants. A participant is considered active if the participation rate is in the third quartile (upper quartile) and he/she is considered passive if the participation level is in the first quartile (lower quartile) (Lipponen et al., 2001). Consistently, students’ participation level is considered high when their involvement for each activity (responses/post) are located at the third quartile and is considered low if located on the first quartile. A student is considered as a bridging participant if his/her value of betweenness centrality is located in the upper quartile of the group. Participants also considered the leader of information if the in-degree value is at the third quartile in the group. A student is identified as at-risk participant when the in-degree or out-degree value is located at lower quartile in the forum. Participants also identified as isolated participants if they have zero in-degree value.

- **Degree Centrality**
  Degree Centrality is used to evaluate network connectivity. This information can be found by measuring in-degree and out-degree - the number of a student’s connection (links) with the other participants. In-degree centrality measures the relation of a participant when received messages from others. Out-degree centrality means a participant sent messages to others. A participant is identified as more active in spreading information, opinion, comment or discussion if the value of out-degree centrality is high. In other words, it means the particular participant is influential in the network and popular. A leader of information is often associated with the high centrality (Brass, 1992), while the isolated participants are the those who may not have contact with peers (McDonald, Stuckey, Noakes & Nyrop, 2005).

- **Closeness Centrality**
  The closeness centrality is the individual’s close position with others in the network. Nodes with high closeness centrality are participants closely with the others in the network. They can access all other nodes in the network easily. Students with high closeness values interact with others faster and often effective in transferring information. They also no longer rely on others to reach all participants in the network. Conversely, when a student has a low closeness value, but with the high central, he/she can receive the information flow in the network quickly. The speed of information spread in the network depends on the link in the path traveled. These students gain more contacts easily, easy to interact with others and more prone to influence to perform a task.

- **Betweenness Centrality**
  Betweenness refers to the extent a node lies between other nodes in a network. Participant with high betweenness value is called bridging participant or mediator. These participants can control the flow of information between
students. A node with a high betweenness value regarded as a leader by other participants in the network (Mullen & Salas, 1991) as they help to coordinate the tasks and information flow in the network. If a network has an average high betweenness value, this shows there are mediators of information exist in the network.

- **Eigenvector Centrality**
  Eigenvector is to measure participants communication with active or passive participants in the group. If the eigenvector centrality is located on the third quartile in the group, it indicates that the participant tends to interact with active members. Conversely, if the eigenvector centrality is in the first quartile, it show that the participant tends to interact with students who are not active.

- **Density**
  Density is used to show student involvement in the network as a whole. As the density value of a network is 100%, this shows all students communicate with one another. Conversely, if the density is 0, meaning the network does not have any communication or contact among participants. In this study, participants are considered to interact at a high level or connected to each other if they have a high density of more than 75%.

- **Direction of Interaction**
  Direction of interaction indicates to whom a participant’s response to in a discussion forum. It is shown by the arrows in a network diagram. There are two types of interaction direction: unidirectional and reciprocal interaction.

3. **Theories**

The next section will discuss the three theories (social constructivism, theory of online learning and connectivism theory) that form the base of this study’s framework.

3.1. **Social constructivism**

Social Constructivism provides solid theoretical foundation in providing guidelines for contrive discussion to enhance learning. Social interaction among participants in the learning context is seen as the primary source of cognitive and social development. This theory provides a deeper understanding on how a student acquires knowledge by interacting with a knowledgeable someone actively. Vygotsky (1978) introduced the concept of Zone of Proximal Development (ZPD), which means the distance between the actual development and the level of potential development that can be achieved through adult guidance or in collaboration with a peer who is more knowledgeable. This ZPD can be achieved by using scaffolding in the form of encouragement, guidance or reminders to help and motivate students to complete a given task. Involvement and interaction of students in group discussions provide them with the opportunity to make generalizations and transfer their knowledge, to synthesize the ideas of others and build an understanding to facilitate learning. This theory also emphasizes the importance of feedback in order to help individuals construct their knowledge. Based on the social constructivism learning theory, this study proposes using asynchronous discussion forums with collaborative learning method to analyze students’ knowledge construction level.

- **Collaborative**
  Collaborative refers to students who work in small groups to do activities that are shared with the same goal. According to Vygotsky (1978), individuals learn more effectively by using a collaborative learning method. Students build collaborative knowledge through an interactive process involving sharing, consultation and modification of information (Gunawardena, et al., 1997). Through feedback, interaction and scaffolding, students will be able to build new knowledge. In this study, students are expected to actively construct meaning based on their existing knowledge and experience due to interactions in the online forum. From the perspective of social constructivist, learning is a social activity that involves the construction of shared knowledge.
3.2. Theory of online learning

Theory of online learning refers to the preparation of learning in an online environment where interaction is the basic element of this theory. This theory was proposed by Terry Anderson (2004), who emphasizes that an effective learning environment should involve interaction between three macro components, namely students, instructors and content. This interaction will develop individual learning experiences on a deep level of new knowledge construction (Anderson, 2004). As such, Anderson (2003) argues that a deep and meaningful interactions will occur as long as one of the three forms of interaction (students to instructors, student to student or student to the content) exists at a high level. This study focuses on dialogue and discussion in an asynchronous discussion conducted in a hybrid learning environment. Similarly, six types of interactions, recommended by Anderson and Garrison (1998) can be simply applied in an asynchronous discussion forum environment. Multilateral interaction directly affects the meaningful learning occur through a collaborative approach in exchanging knowledge. The three most interactions in asynchronous discussion forum inclusive of; (a) student-instructor (involve dialogue and feedback), (b) student-student (involve the exchange of ideas, information and dialogue among peers, using collaborative approach) and (c) students-content (i.e., learning contents, course materials). Essentially, in online environment, all interactions, including interaction with content, peers and instructors occur through the interface (in this case: the computer). In summary, this online learning theory emphasizes on an interactive learning in order to achieve meaningful learning using a collaborative approach. Asynchronous discussion forums can provide opportunities for students to interact with contents (simulation of cognitive), instructors (support and enhance learning) and student to student (social interaction) in achieving learning outcomes.

3.3. Connectivism theory

Connectivism theory means network-based learning. George Siemens is the founder of the Connectivism theory and introduced it as a learning theory for the digital age (Siemens, 2004). Based on this theory, the learning process involves cognitive and affective domains. Connectivism emphasizes two important skills in the learning process is the ability to find the latest information and filter the information. Along this line, sharing knowledge is a vital component of this theory. It is important for the node to identify the resources that are reliable, and distinguish important information to create critical thinking. At the same time, the accuracy and validity of the information may also change. This theory allows students to gain experience of active learning by finding, presenting, analyzing, evaluating and making sense of relevant knowledge and geared towards meaningful learning. Students play an important role in determining the content of learning, communication and participation. The ability of students to see the relationship between a particular field, idea and concept is the basic skills (Siemens, 2008). The activity in forum allows students to share their knowledge in the process of finding and acquiring new information that can be trusted as well as determine the links that allow them to gain experience of active learning. Overall, connectivism allows students and teachers to access the latest information as well as to provide meaningful learning opportunities.

4. Conceptual framework

Conceptual Framework (Figure 1) is grounded on social constructivist learning theory. Two additional theories supporting this study are theory of online learning and Connectivism. In order for meaningful discussion to occur, an interactive interaction should take place in a constructivist learning environment. In addition, based on social constructivist learning theory, asynchronous discussion forum using collaborative approach is proposed in this study. This forum is conducted using an online learning facility in hybrid mode and supported by the theory of online learning. Theory of online learning emphasizes interaction and the computer interface acts as mediator for communication to occur between peers, instructor and content. Principles of connectivism are applied by the students in order to produce meaningful learning. To collect a comprehensive data on students’ engagement and also on knowledge construction, three methods of analysis are proposed in this study: (i) content analysis, (ii) listening behavior (categorization of students according to their level of interaction) and (iii) social network analysis (SNA).
This study also attempts to examine the correlation between the level of knowledge construction and social network, for instance between centrality and the knowledge level. Consistently, Gunawardena et al., (1997) claimed that high level of interaction will produce a high level of knowledge construction as well.

5. Contribution to knowledge

This framework has also made some contributions to the knowledge about online discussion forums.

- The main contribution of this study, is perhaps the multiple analyses in order to obtain comprehensive and extended information on students’ engagement and knowledge construction. This study has proposed three methods of analysis on the forum content, namely, content analysis, cluster analysis and social network analysis. It is hoped that this suggestion will contribute to the online discussion literature.

- Cluster analysis on the patterns of listening behavior proposed by Wise (2012) is not widely used. Thus, the authors suggest this analysis to be used in evaluating the students’ interaction level. This method can assist the instructor in identifying the types/clusters of students in order to facilitate teaching and learning using online discussion (especially to increase their levels of interaction and knowledge construction).

- Next, the combination of three theories (social constructivism, theory of online learning, Connectivism theory) that formed the theoretical proposal will contribute to the online discussion literature.

- Thus, this study provides a conceptual framework for further studies, especially for future research in online learning environment.
6. Conclusion

Realizing the importance of social interaction in producing higher knowledge construction, enhancement on students’ achievement and producing critical thinkers, this study attempts to innovate a conceptual framework. The results of this study are expected to increase knowledge construction and interaction levels using a collaborative approach. Therefore, learning can be most effective when appropriate methods are applied to achieve its goal. This conceptual framework may aid and contribute as an alternative approach to instructors in monitoring the students’ engagement and social interaction level. The proposed conceptual framework may benefit higher institutions.

References


