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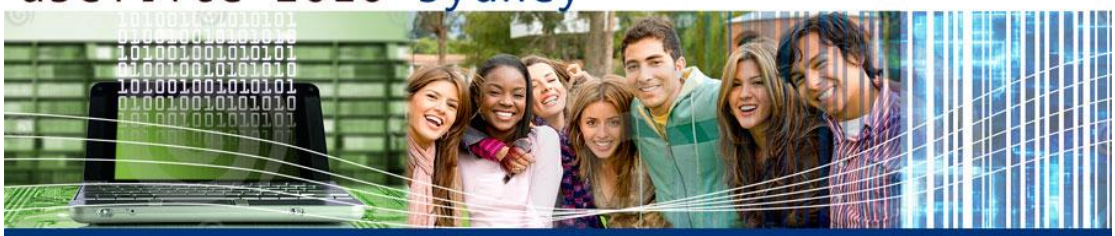

The relationship between group size and advanced level knowledge construction in asynchronous online discussion environments

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This study is part of a funded research project that examines possible factors that may influence students' advanced level of knowledge construction. This study examines if group size of the online discussion is related to the frequency of advanced level of knowledge construction occurrences. Group size of an online discussion refers to the number of people who contributed in the discussion. Advanced levels of knowledge construction refer to levels II, III, IV, or V of Gunawardena, Lowe, and Anderson's (1997) interaction analysis model. Data were collected from 28 asynchronous online discussion forums. Results showed a significant positive correlation between group size and advanced level knowledge construction; suggesting that the larger the group size of the online discussion is, the more frequent the occurrences of advanced level knowledge construction would be. Further analysis between the more successful and less successful forums suggested that a certain critical mass, which appears to be a group size of about 10 participants may be required to direct the discussion to advanced levels of knowledge construction.

Keywords: asynchronous online discussion, group size, knowledge construction, computer-mediated collaborative learning

Introduction

Traditionally, the education of learners involved the notion of teachers transmitting information and facts to the minds of the audience (Roehler & Cantlon, 1997). Current trends in the field of learning and instruction, however, emphasize the social constructivist learning paradigm, favouring learning environments that afford learners the opportunity for collaborative learning (van Drie, van Boxtel, Jaspers, & Kanselaar, 2005). One key factor that can determine the success of collaborative learning can be found in the quality of the knowledge constructions students engage in.

The quality of knowledge construction can be assessed by examining the different levels it occurs, typically through the use of content analysis models. The interaction analysis model by Gunawardena et al. (1997) is considered one of the most appropriate and straightforward schemes in analyzing student knowledge construction in social constructivist and collaborative learning environments (Lally, 2001).

Specifically, the interaction analysis model posits that knowledge construction occurs through five levels:

(a) Level 1 – making statement of observation or opinion, statement of agreement among participants;
(b) Level II - identifying areas of disagreement, asking, or answering questions to clarify disagreement
(c) Level III - negotiating the meaning of terms, ideas/co-construction of knowledge;
(d) Level IV - testing of proposed synthesis or construction against existing literature or personal understandings, experiences; and
(e) Level V - summarizing agreement/statements that show new knowledge construction, application of newly constructed ideas. In this study, we defined advanced levels of knowledge construction as levels II, III, IV, or V of the model.

The use of information and communication technology (ICT) tools can present new ways to foster knowledge construction (Schellens & Valcke, 2006). ICT tools can help facilitate the construction of knowledge by functioning as a social medium to support students' learning by discussion and representing students' ideas and understandings in concrete forms (e.g., notes) so that ideas can be further developed through social interactions (e.g., questioning, clarifying) (van Drie et al., 2005). One example of such ICT tools is the asynchronous discussion forum. Advocates suggest that the use of asynchronous online discussion forums can foster advanced levels of student knowledge construction discourse. However, many previous studies on these forums have found that students' knowledge construction rarely reaches advanced levels such as phases II, III, IV, or V (e.g., Gunawardena et al., 1997; Kanuka & Anderson, 1998; Jamaludin & Quek, 2006). How then can the quality of student knowledge construction in online discussions be enhanced?

Previous empirical findings have suggested that advanced levels of knowledge construction may be found in the following contexts: (a) when students engage in structured tasks (e.g., when they were explicitly required to identify the various dimensions of a problem, debate solutions, propose a synthesis, test synthesis against certain principles, and provide a summary) (Aviv, Erlich, Ravid, Geva, 2003), (b) when certain roles or strategies are employed (e.g., the role of summarizer resulted in advanced levels, rather than the role of source searchers) (Schellens et al., 2007), (c) when the discussion task is not be too easy or complicated but matches the participants' abilities (Schellens et al., 2007), or (d) when certain habits of mind are displayed in the discussion (e.g., showing awareness of own thinking, accuracy and seeks accuracy, open-mindedness, and taking a position) (Hew & Cheung, in press). More recently, some researchers have examined if group size might influence the levels of knowledge construction in online discussion forums. Schellens and Valcke (2006), for example, found that discussion in groups of about 10 participants resulted in larger proportions of advanced levels of knowledge construction. Hew and Cheung (2010) examined if there was any relationship between the frequency of advanced level knowledge construction occurrences and group size. The researchers found a significant positive correlation between the discussion group size and the frequency of advanced level knowledge construction occurrences. However, no indication was provided by Hew and Cheung (2010) about the possible optimal group size.

Research aim and questions

The specific aim of this study is to replicate prior research on group size pertaining to knowledge construction in online discussions in order to test the consistency of the previous results (e.g., Hew & Cheung, 2010; Schellens & Valcke, 2006). Specifically, the following research questions were examined:

Is there a relationship between the frequency of advanced level knowledge construction occurrences and the group size of the discussion forums?
We refer the group size of an online discussion to the number of people who participated in the discussion. There are fundamentally two forms of participation in an online discussion environment: writing messages and reading messages (Hewitt & Brent, 2007). In this research study, we are mainly interested in the writing form of participation because writing is closely tied with discussion, and it can subsume reading (e.g., when the student is replying to messages from an existing discussion thread) (Guzdial & Turns, 2000). We hypothesize that forums that have more participants contributing to the discussion would exhibit more frequent advanced knowledge construction levels.

What is the mean group size of the more successful forums versus the less successful forums?

The answer to this question could provide an indication to a certain critical mass, possibly an optimum discussion group size which may be required to direct the discussion to advanced levels of knowledge construction. We define more successful forums as discussion forums that had greater occurrences of advanced knowledge construction levels. As the mean number of levels II to V occurrences was 4.75 for the entire 28 forums, we considered forums with 5 or more levels II to V instances as the more successful forums. Fourteen such forums were found. The remaining 14 forums were considered to be the less successful forums.

Method

Twenty eight discussion forums were selected for the study. These 28 forums came from three courses conducted at a major Asia Pacific teacher education institute: Course I with 12 forums, Course II with 7 forums, and Course III with 9 forums. Participation marks were given for the online discussions in all courses. No number of posting quota was imposed. Students were free to contribute in whichever discussion forum they wished. All 28 discussion forums were completely facilitated by the students themselves and used the same software (i.e., BlackBoard) as its threaded asynchronous discussion environment. The nature of the discussion assignments was also similar for all the forums in the research, regardless of the cohorts: the same activity (i.e., ill-structured design task of instructional materials), context (i.e., instructional materials to be used in primary or secondary school contexts), time requirements (i.e., two weeks of discussion) and deliverables (i.e., storyboards of the instructional materials). Students were expected to use the discussion forums to identify possible design problems of their peers' design projects, provide viewpoints or suggestions for improvements, and respond to the comments raised.

Data collection and analysis

We used Gunawardena et al.'s (1997) interaction analysis model to assess the levels of knowledge construction. Content analysis of the students' online discussion transcript was carried out (Hew, Liu, Martinez, Bonk, & Lee, 2004). An independent coder coded the entire discussion transcripts using the thematic unit (i.e., single thought unit or idea) as the unit of analysis for evidence of knowledge construction. To assess the reliability of the coding, a second independent coder independently coded approximately 10% (randomly selected) of the online postings. Overall agreement of the coding was 80.6%. Once the data had been coded, we counted the frequency of occurrences for each knowledge construction levels in each discussion forum. The sum of the frequency of levels II, III, IV and V occurrences constituted the frequency of advanced level of knowledge construction. For example, if a forum had 10, 7, 5, and 3 levels II, III, IV, and V respectively, the frequency of advanced knowledge construction level would be 25. The group sizes of the discussion forums ranged from a low of 1 to a high of 12.

Results and discussion

Is there a relationship between the frequency of advanced level knowledge construction occurrences and the group size of the discussion forums?
A Pearson product moment correlation coefficient was calculated to determine whether a statistically significant relationship existed between group size and the frequency of advanced level knowledge construction occurrences. Results revealed a significant positive relationship ($r = 0.706$, $p = 0.000$). This suggested that advanced levels of knowledge construction tend to occur more frequently in larger forums. This finding is in line with the previous finding of Hew and Cheung (2010).

What is the mean group size of the more successful forums versus the less successful forums?
Results of a t-test revealed that the mean group size of the more successful forums (M=9.79, SD=1.369) differed significantly at the 0.05 level of significance to that of the less successful forums (M=5.21, SD=3.378), $t(17.157) = -4.693$, $p = .000$. This result suggests that groups of about 10 participants perform at a qualitatively greater level as far as the attainment of advanced knowledge construction levels is concerned.

Why do larger groups tend to exhibit more advanced levels of knowledge construction in online discussions? One possible reason is that participants in larger groups have access to a greater range of opinions or viewpoints when compared to participants in smaller groups. This provides greater opportunities for participants in larger groups to identify the differences between the contributions, to

consider all the opinions, and to negotiate the various meanings of ideas or comments raised. Such activities would help foster the attainment of advanced levels of knowledge construction. Does this, therefore, mean that we should keep on increasing the group size of a discussion indefinitely? This may not be wise due to the following reasons. First, too large a group would encourage the problem of free riding or lurking on the part of the participants. Second, too large a group can invoke extraneous cognitive load onto the participants (Schellens & Valcke, 2006) as they need to potentially deal with large quantities of postings. This could lead to reading fatigue, and cause the participants to stop contributing in the discussion altogether. Our current research finding suggests a group size of about 10 participants may be required to form a critical mass to direct the discussion to advanced levels of knowledge construction. This finding is consistent with the findings of Schellens and Valcke (2006).

Limitations and future research

This study is limited to the examination of group size of the online discussion. Participants were students at an Asia Pacific teacher education institute who were involved in an ill-structured design task. Future research should replicate the study in other contexts (e.g., involving participants from other countries, or participants engaging in a different discussion activity). Besides the discussion group size, there are still other possible factors that may influence students' attainment of advanced knowledge construction levels. We are currently examining some of these factors, including the duration of the discussion, as well as the facilitation techniques employed by the students in the discussion. Answers to these research efforts would provide additional insights as to how advanced level of student knowledge construction can be fostered.

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