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# An examination of online learning effectiveness using data mining

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**Abstract**

Online learning has become increasingly popular due to technology advancement that allows discussion to occur at distance. Most studies report on students' learning achievement as a result of effective online learning while assessment on the learning process is also necessary. It is possible by applying data mining technique where students' online learning experiences can be assessed based on their log files. This study found that students could also perform well by being a silent learner during online learning. However, students have to spend more effort to be a successful silent learner as suggested by the produced predictive model.



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*Keywords:* Online learning; collaborative learning; data mining; learning perfomances; predictive model

## 1. Introduction

Online learning offers possibility to implement various instructional designs. With technology advancement, online learning comes in handy for collaborative learning implementation because group collaboration can occur at distance and thus favours divergent thinking, and exploration of multiple perspectives as compared to face-to-face collaboration (Swan, 2003). More importantly, online learning keeps track of students' learning activities where assessment on their collaborative learning experiences can be conducted. Macdonald (2003) underlined the importance of assessing online collaborative learning, as it will provide guidelines and ways to improve students' competency. The assessment will

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help students to display interaction behaviour that contributes to their learning and encourage them to foster participation during collaboration.

Although the advantages of online collaborative learning are well known (Springer et al., 1999; Stacey, 1999), different pedagogical strategies will have different impact on students' learning especially when different learning tasks were integrated within a specific course (Zafeiriou et al., 2001). Most studies on assessing the effectiveness of online collaborative learning emphasize on the product of learning in the form of learning achievement based on the collaborative work (Macdonald, 2003). There are also studies that report on students' perception about online collaborative learning experiences as indicator of successful online collaborative learning (Dewiyanti et al., 2007). These studies gave us information that collaborative learning can results in better knowledge acquisition while some studies reported differently. A more robust investigation has to be carried out to explore the effects of online collaborative learning intervention on students' learning.

Janssen et al (2007) found that investigation on students' participation during learning will enhance the group awareness and promotes coordination and regulation of social activities for collaboration. However, students' participation in online learning is expressed in various forms. In Fung (2004), students' participation in online collaborative learning is defined as students' interaction activity of posting messages and replying messages that relates to tasks while students' activity of 'viewing messages' is not considered as an 'active' participation. Similarly, Lipponen et al. (2003) defined reading messages as only 'lurking' and it is not an indication of participation. However, there are other learning attributes that could serve as useful indicators of students' participation during online collaborative learning.

## 2. Background of Problem

The growing interest in online collaborative learning has induced several challenges in assessing online collaborative learning experiences. The importance of assessing online collaborative learning experiences are highlighted by Brindley, Blaschke and Walti (2009) where assessment will encourage participation in online collaborative learning that results in better learning outcomes and skills acquisition. Most studies assessed students' online collaboration based on students' learning outcome as a product of collaboration (Macdonald, 2003) while a handful of information can be retrieved from students' log files available in online databases that signify learning processes have occurred (Fung, 2004; Cocea & Weibelzahl, 2007; Hung & Zhang, 2008).

In Cocea and Weibelzahl (2007), students' log files were retrieved from online learning databases to identify students' engagement. They defined 'engagement' based on number of pages that the students read, time spent reading the pages, and time spent on quizzes. Similarly, log files from online learning databases were used to understand students' motivation in learning based on their participation in the provided learning activities such as drills, games and self-test (Ben-zadok et al., 2011). Hung and Zhang (2008) evaluate students' participation in online learning based on students' log files and then identify the important parameters of participation that can predict better learning outcome. These and many more studies evaluate students' online learning experiences based on the available online learning log files.

Data mining technique is the technique that discovers potentially useful information from the bulk amount of data retrieved from online databases (Han, Kamber & Pei, 2011). It is a data analysis technique commonly used in business and management but becomes increasingly popular in educational research. In some studies, data mining technique is used to predict students' dropout cases (Dekker, Pechenizkiy and Vleeshouwers, 2009; Kotsiantis, 2009) and also predict students' performance based on the current available data about the students (Kovačić, 2010; Bhardwaj & Pal, 2012). Consequently, using the similar technique, students' participation in online collaborative learning can also be assessed vigorously other than primary assessment on students' learning outcome. Dringus and Ellis (2005) stated that the indicators of participation in online learning can be based on students' interaction (such as responding to messages), sharing resources and including lurking (spending time to read messages, viewing resources).

Assessing students' online collaborative learning experiences using data mining technique will provide a useful solution for teachers to understand the influence of students' participation during online collaboration on students' learning achievement. Based on the results, teachers will be informed about the important parameters for students' success (Hung and Zhang, 2008). The obtained information will be a very significant measure of the online