

Time Dimensional Analysis of Online Collaboration in a Blended-Learning Context

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Abstract: Educators believe in the value of collaborative learning in higher education. Conventional universities are increasingly adopting web-based learning support systems to facilitate students' collaborative learning activities. However, little research has been conducted to understand the mechanism of collaborative learning as Hewitt (2004) argued. Therefore, this study is to conduct a time dimensional analysis of online collaboration in a blended-learning context. One of such analysis is related to assessing students' use of time in online collaboration. This case study presents an exploratory analysis of two groups of students (n=13), involved in a collaborative knowledge building task. The students participated in two weeks Moodle-based collaborative activity, and log data which is accumulated in Moodle such as written messages, groups' final outputs, and individual reflection notes, are collected. It attempts to analyze the quantitative and qualitative changes in the students' written messages along with critical time dimensions. In addition, it investigates the relationships between group's specific time related pattern, group performance, and individual learning experience. This paper concludes with implications of the results.

Keywords: *Online collaboration, Time, Pattern analysis, Blended-learning context*

Introduction

The ability to collaborate with others is one of the key competencies required for learners in the unpredictable and rapidly changing 21st world (Ananiadou & Claro, 2009) as collaboration often leads to improved learning achievement and better behaviors. Graham and Misanchuk (2004) argue that collaboration enables synergistic problem solving. Cunningham (1992) explains that it is only through collaboration that students can challenge their own world views and begin to understand others' perspectives. Brookfield (1995) argues that the ability to create knowledge is enhanced when working in small groups, teams, or even on the discussion board. All these arguments support that collaboration assists with deeper levels of knowledge generation, and further promotes initiative, creativity, and critical thinking.

Many campus-based conventional university are integrating learning and teaching support system such as 'Moodle' into their curriculum to support student collaborative learning activity as well as teacher and student interaction. The distinctive advantage of integrating online learning activity is that students can participate in learning activity whenever they are available beyond their presence in school. This time flexibility is one of the strong points that the students expect (Petrides, 2002). However the flexibility is reduced by group collaboration comparing to individual activity; the level of interdependence reduces individual time flexibility (Demeure, Romero, & Lambropoulos, 2010). In addition, online collaboration requires not only that the students coordinate with other's schedules but also that a student conciliate all his or her professional, social, and academic activities (Frankola, 2001). Therefore, this paper argues that time is a critical variable for students' collaboration in online.

For those reasons, we believe that temporal patterns of e-learning need to be explored deeply. A temporal pattern refers to structures appearing periodically within a given temporal rhythm (Demeure, et. al., 2010), and the patterns enable understanding the past events and the anticipation of future actions. This study attempts to analyze the quantitative and qualitative changes in the written messages along with critical time dimension; longitudinal, weekly, daily level. In addition, it investigate the relationship between groups' specific pattern, group performance, and individual learning experience. Finally, it discusses the implication of the research results.

Methodology

Research context

The course in which the study took place was taught at a private university in Tokyo. The main objective of the course was to introduce the theories, practices, and applications of instructional design and technology. It consisted of 20 sessions taught from September 6th to November 10, ten weeks. Two consecutive sessions were conducted by the instructor once a week, and the language of instruction was English.

65 undergraduate students enrolled in the course, and they were assigned by ten groups. All groups were given the same tasks which included groups' online discussion on the definition of learning for ten days and writing a group report about the group's belief of learning and instructional strategies to promote such learning. In addition, every individual should submit their reflection note on the online group activity. This tasks counted for 30% of the course's total grade in order to enhance students' participation and seriousness in the online activity.

Table 1. Activities' schedule in the study

Date	Stage
September 13	<ul style="list-style-type: none">• Group formation
September 20	<ul style="list-style-type: none">• Face-to-face meeting during class.• Getting the students' consent to collect their data
September 21 to 30	<ul style="list-style-type: none">• Online collaboration period using Moodle or LINE
October 1 to 4	<ul style="list-style-type: none">• Summarizing your group discussion in a group report (500- 700 words).
October 4	<ul style="list-style-type: none">• Submitting a short reflection note (100 - 200 words) on this online group activity individually.

Data collection and analysis

We collected the students' messages, group reports, and individual reflection notes. Although a total of 10 groups were formed, this study selected two groups that posted more than 40 messages as the research subjects. We made this judgment because some certain amount of messages are needed to be analyzed meaningfully.

First, we focused on analyzing the date and time of students' posting. We adopt three level analysis. The

first level is longitudinal duration of collaboration; in this study, online collaboration took place for ten days. The second level is the weekly level; the week is the main time pattern in the organization of human activity. Within the week, we can differentiate the time spent on weekdays and spent on weekend. For the daily level, we choose to the categories used in Demeure, et. al. (2010). In their study, they examine the time spent on the internet according to six time blocks: night corresponds to 1 a.m. to 5 a.m.; early morning corresponds to 6 a.m. to 9 a.m.; late morning from 10 a.m. to 1 p.m.; afternoon from 2 p.m. to 5 p.m.; early evening from 6 p.m. to 9 p.m.; late evening from 10 p.m. to 1 a.m..

Next, we read each of the discussion messages' transcript and assigned each messages into the corresponding level of cognitive engagement level according to Zhu (2006)'s framework. The unit of analysis was per posted message. In the case that there are several levels of cognitive engagement in a single message, we decided on choosing one in terms of the most main content. The analytical framework for cognitive engagement level is described in the below table 1.

Table 1 Analytical framework for cognitive engagement (Zhu, 2006)

Category	Description
Question of seeking information	Question that has a direct/correct answer
Question of Inquiring discussion	Question that has no direct/correct answer
Responding statement	Direct response to a previous message(s), offering feedback, opinion, etc.
Informative statement	Providing anecdotal/personal information related to the topic under discussion
Explanatory statement	Presenting factual information with limited personal opinions
Analytical statement	Analytical opinions about responding messages
Synthesizing statement	Summarizing of discussion messages
Evaluative statement	Providing evaluative or judgmental opinions of key points in the discussion
Reflective statement	Reflecting on changes in personal opinions, behaviors and one's use of cognitive skills in accomplishing a task
Mentoring statement	Explaining how the understanding of a particular concept, idea, etc. is reached
Scaffolding statement	Guiding students by offering suggestions.

Results

In longitudinal time flow, two groups show quite different pattern. One group shows a continuous message exchange overall, whereas another group shows that the intensive message exchange has been occurred for the last four days. According to the students' reflection note, it is found that the cramming group spends one week for brainstorming by individual on the topic, and they had a face-to-face meeting one week later. Their intensive online interaction started after the face-to-face meeting. In terms of cognitive engagement, the cramming group shows high cognitively engaging dialogue such as synthesizing, evaluative statement and reflection more frequently than the consistent group despite of short period.

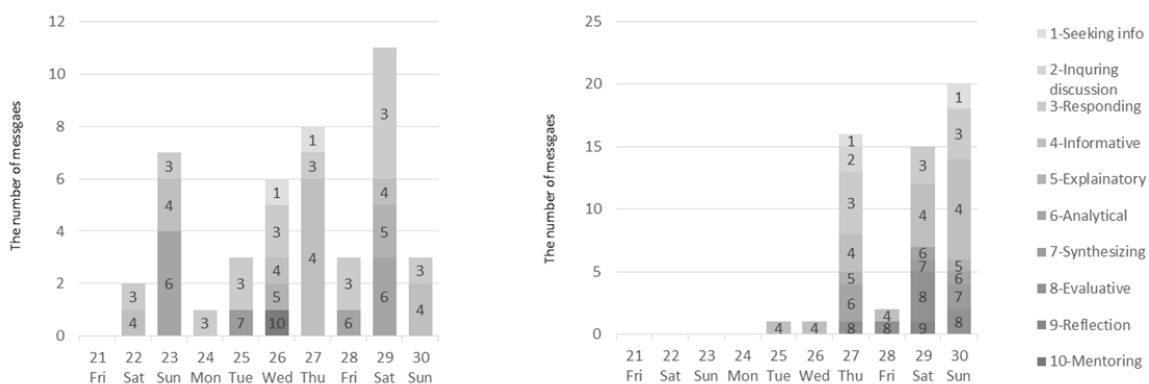


Figure 1. The consistent and cramming pattern in longitudinal analysis

In daily analysis, both groups showed that many messages were exchanged in the early evening and few messages were posted at night and early morning. However, two groups shows opposite results on the afternoon period and late evening period. In the consistent group, many messages were posted late evening but only a few messages in the afternoon, whereas in the cramming group, many messages were posted in the afternoon but a few messages late evening.

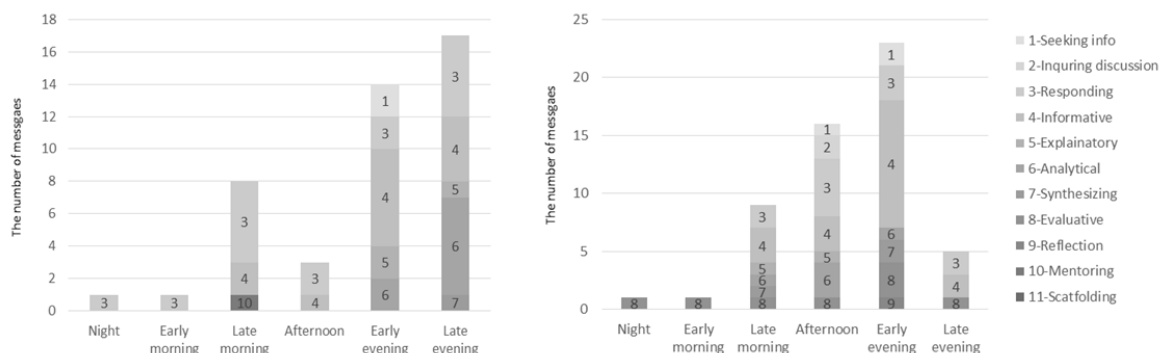


Figure 2. Daily activity pattern of the consistent group(left) and the cramming group(right)

Even though we cannot find the relationships between group specific time related pattern of interaction, group performance, and group members' individual learning experience through the data, it is found that the students express some conflicting opinions and feelings about learning experience of online collaboration in terms of time. The detail is described in the Table 2.

Table 2. Summary of positive and negative aspects of the students' reflection notes

Positive aspects	Negative aspects
<p>1) Time flexibility</p> <ul style="list-style-type: none"> - Online discussion was good for me because I could write when I want to write. - People can write and edit their comments at any time - I could read and write comments when I like. This did not bother my schedule and others', too. - It was easy to manage time and schedule. <p>2) Enough time to think deeply</p> <ul style="list-style-type: none"> - There are time to think about discussion topic. - We can think deeply and polish our thoughts because we have time to think - Online discussion was great as it enables me to use loner time to organize and state my opinion. - We have enough time to think deeply about the theme or what others says. - I could take time to think before I posted my opinion - There was enough time to think before I said something. <p>3) Time to repeat and review</p> <ul style="list-style-type: none"> - We can share much opinion, and rethink, revise those again and again by reading other's opinion. - It is easy to trace the previous discussion - I also checked Moodle many times, and posted my ideas. I really inspired from this activity. - I tried to open and see how the discussion is going on every day, so I was able to keep up myself and contribute to group. 	<p>1) Time lag</p> <ul style="list-style-type: none"> - In the online, we can't explain or correct our opinion immediately. - All of members are not reading messages anytime/ anywhere. - Discussion does not proceed well - I had to wait until other members responded. It was difficult to expand the topic. - I feel uncomfortable because there are time lags among people <p>2) Too much time-cost</p> <ul style="list-style-type: none"> - Matching our idea was too difficult and caused too much time - I felt stress because I used a lot of power; I had a part time, but I should reply other members' comments and always think about topic. <p>2) Hard to catch-up</p> <ul style="list-style-type: none"> - When the argument was developed during my absence in online, some points of the discussion were already concluded before I joined. - While I was away from the moodle, many posts were made. At that time, I felt a little hard to catch up with them.

Discussions

The means of the students' scores of these two groups are higher than other 8 groups'. It may be natural result because the number of posted messages is critical indicator for the degree of students' participation. More intensive participation should be related to higher learning achievement. Hmelo-Silver, Chernobilsky, and Jordan (2008) revealed that the students in successful group were posting more messages and engaged with each other's ideas. In this study, the instructor rarely intervened in online group activity in order to be fair to all groups. This might produce the result that a majority of groups showed low students' participation in online activity. There is a consensus among researchers on the importance of the instructor's leadership and behavior in online collaborative learning in supporting group learning processes (Pea, 2004). According to Ruthven, Hennessy, and Deaney (2005), one of important aspects in adopting web technology is instructor's ability to motivate and encourage students when they show difficulties in getting started or are not willing to take the next step, and they argue that students sometimes only need an initial spark and then can perform the activity on their own.

In addition, we wish to know when prime learning time for young people is through three level analysis. However, the results don't give an obvious time-zone as an answer. Instead, we found that the cramming group actively used conventional school hour, from 10am to 5pm and early evening, whereas the consistent group mostly used evening time, from 6pm to 1am. It is strong point of online activity that online learners can organize and use time valuably by using residual time (e.g. weekend, late night, etc.) when there are less work and family constraints. On the other hand, it is argued that people organize their time and perform on the task better in a structured environment (e.g. weekdays than weekend) because the time constraints encourage people to be serious for scheduling a specific time for a specific task (Demeure, et. al., 2010). Therefore, it will be interesting future research to compare the quality of collaboration during weekdays and weekend or conventional school hours and late night or early morning.

Furthermore, in both groups, the students started their online discussion about the task itself. This result is not corresponding with the previous research that explains students need social activities in the beginning point of the task period and their behaviors are getting to concentrate on the task itself from the mid-point while online collaboration (Michinov & Michinov, 2007). This conflicting result may be caused from different research context. A majority of studies have been conducted in full time of online courses, but this study is conducted in a blended-learning context which is usually conventional universities' one. In a blended context, the students almost know each other and are able to meet in person regularly at the classroom, so they may not need social activity to get know each other or make some friendship before undertaking the task. This blended context enables students to embark their collaboration for the task more quickly, but the reality is often likely to turn out students' procrastination or low participation as other eight groups showed. It will be helpful to find instructional strategies to use the characteristics of a blended context for students' effective and efficient online collaboration while solving those problems.

Finally, this study reveals that it is not only matter that the students participate in online activity consistently, but also the quality of interaction is critical for successful online collaboration. Even if the group discussion crams for the deadline, they can reach a good conclusion through engaging intensively and deeply with each other messages. Another critical aspect is that the cramming group's students had one week of individual brainstorming period and then got together to have a face-to-face meeting. Actually, one of issues with online collaboration is to establish an appropriate level of interdependence between group members, and Graham and Micanchuk (2004) argue that the most effective case is shown in the groups who chose to use the divide and conquer approach to completing the task and individual tasks were assigned based on group member strengths. Therefore, it will be valuable to examine how much of time the students need for studying and researching on the task by individual before collaborating with others and how much of time is necessarily needed or enough for students to collaborate over the specific task period.

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