Analysis of Time-Management Pattern of Interactive Behaviors during Online Project-Based Learning

Huei-Tse Hou¹, Kuo-En Chang¹ and Yao-Ting Sung²

1. Graduate Institute of Information and Computer Education,
National Taiwan Normal University, Taipei, Taiwan
ho@ice.ntnu.edu.tw; kchang@ice.ntnu.edu.tw
2. Department of Educational Psychology and Counseling
National Taiwan Normal University, Taipei, Taiwan
sungtc@ntnu.edu.tw

Abstract
This study aims to explore the time-management patterns of learners’ interactive behaviors during online project-based learning (PBL) from an empirical observation without teachers' interception. According to the derived pattern, the study found how learners allocated their time and how these interactive activities influence learners to allocate their time more appropriately. Finally, we also gave some suggestions for teachers’ interception and guidance for promoting the quality of students' projects.

1. Introduction
Project-based learning (PBL) is a learner-centered instructional method. Learners can learn by proposing their project topics, gathering and analyzing information, discussing and sharing with peers during PBL activities [1] [2] [3] [4]. Over recent years, the application of PBL strategy for teaching via e-learning environment has become progressively popular. However, past studies pointed that during the learning process of PBL, learners often face difficulties of planning appropriate time-management strategies to their project [5] [6]. Inappropriate time allocation may then cause insufficient data collection or incorrect analysis [7] [8], and may influences the quality of their projects.

On the other hand, for promoting the learners’ interaction during the online PBL, applications of various online interactive activities (such as online discussions, data sharing or peer assessment) may hopefully promote the depth of learners’ analyses of project and these activities also recently being commonly integrated into PBL via web-based learning environments. However, how learners allocate their time during these interactive behaviors? Whether these interactive activities promote learners to allocate their time more appropriately? These issues are rarely been explored recently and it may provide important reference for teachers’ interception and guidance for enhancing learners’ learning by analyzing the time-management patterns of their interactive behaviors during online PBL. Therefore, the purpose of this study is to conduct various interactive activities which are commonly used with online PBL (includes information sharing, peer works viewing, feedbacks providing, proposing and answering questions, a total of 5 activities), and analyze the time-management pattern of learners interactive behaviors from the empirical observation without teachers' interception, then we try to give some suggestions for teachers’ interception and guidance for promoting the quality of their projects according to the derived pattern.

2. Method
2.1 Participants
The participants in this study were 43 students who majored in Information Management in a college of technology in Taipei city. The participants were students from a course, “Management Information System,” which was a course that dealt with the fundamental theories and actual cases of information management.

2.2 Tools
In this study, we used the WIDE (Web-based Instructional Design Environment) platform [9] to conduct the above mentioned online interactive activities as well as to observe the students’ behaviors. The WIDE platform was constructed based on fundamental theories of instructional design. It provides an environment for teachers to upload teaching materials and conduct online instructions. At the same time, WIDE also provides an interface for students to browse the material, compile information, conduct online discussions, and prepare assignments. Interactive learning modules equipped on WIDE provide various functions to assist teachers in conducting online PBL activities. For instance, students can use online forums for discussions and work on problem solving with each other. The document sharing function of WIDE allows learners share and view information with peers. Moreover, learners can give...
feedback to a certain peer by using the peer feedback module of the system. In order to conduct further analysis, the WIDE system also has an automatic record function to record the learners' operations that are related to these interactive behaviors. The system records every operation along with the exact time and the operators.

2.3 Procedures

The online PBL activity was carried out in the semester between May and mid-July in 2005. The students were asked to finish a project before mid-July. Students needed to independently look for an actual company, and then designed an e-commerce system for the company to solve its barriers. The project content included data gathering, analysis, and technical strategies utilized. During this PBL activity, the instructor of the course asked the students to conduct interactive activities on the above mentioned online learning system. The students needed to share information, view peers’ works, give feedback to peers, provide suggestions, ask questions, and answer others’ questions. The students’ overall performances in these activities would be part of the course credit. The teacher would not intervene or guide students’ interactive behaviors in either the physical classroom or on the online forum. The students’ entire operations during the PBL activities were automatically recorded in the database.

2.4 Data analysis

Based on the above mentioned interactive activities, this study developed a code scheme for further analysis. As shown in Table 1, there are 5 behaviors codes in total. All these codes correspond to the users’ operations on the online learning environment (e.g., clicking on a certain button or viewing a certain page). The behaviors, codes, and the descriptions of the behaviors are listed in Table 1:

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing Information</td>
<td>S</td>
<td>Learners gather online learning resources, and give a brief description of the certain resource. These data are uploaded or stored in the database of the system and then shared to the peers.</td>
</tr>
<tr>
<td>Providing Feedback</td>
<td>F</td>
<td>After reading peers’ work or the online learning resources gathered by the peers in the learning database of the system, learners provide feedbacks to the certain author or provider.</td>
</tr>
<tr>
<td>Proposing Question</td>
<td>Q</td>
<td>A learner proposes questions about the project topic on the discussion forum.</td>
</tr>
<tr>
<td>Answering Question</td>
<td>A</td>
<td>Learners provide solutions or comments to questions proposed by their peers on the discussion forum.</td>
</tr>
<tr>
<td>Viewing Peers’ work</td>
<td>V</td>
<td>Learners view the work or learning resources collected by peers.</td>
</tr>
</tbody>
</table>

Since each student had his own time-management plan during the whole PBL activity, in order to get more information about how the students allocate time of different behaviors within the allowed time (e.g., What are the main knowledge sharing behaviors displayed by the students in their initial period of whole operation process?), we then divided each student’s whole operations into the early, middle, and late stages (e.g., If a student makes 300 operations during the entire time of PBL activities, 1st ~ 100th operations would be categorized as his “early” stage, 101st ~ 200th would be categorized as the “middle” stage, and 201st ~ 300th would be categorized as the “late” stage). The recorded operations were then used for further frequency analysis to explore the frequencies allocation of each type of codes at each stage. In addition, the time allocation pattern of the all learners was analyzed as well.

3. Results and Discussion

We organized all recorded operations - a total of 7048 codes during the online PBL activity, and then analyzed the average percentages of all students’ early, middle, and late-stage behaviors as shown in Figure 1.

In order to in-depth explore whether these percentage-variations of each codes between the early-stage to middle-stage and the middle-stage to late-stage reach statistical significance (e.g.: Whether the percentage of a certain behavior increased from early stage to middle-stage significantly?), we subsequently conducted paired sample tests to compare the variations, the results was listed in Table 2.
Table 2 Means and standard deviations of percentages for each type of students’ interactive behaviors in each stage during the online PBL activity

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Stage</th>
<th>Paired Samples Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early (%)</td>
<td>Middle (%)</td>
</tr>
<tr>
<td>Sharing Information (S)</td>
<td>M 20.14</td>
<td>11.21</td>
</tr>
<tr>
<td></td>
<td>SD 23.13</td>
<td>8.24</td>
</tr>
<tr>
<td>Providing Feedback (F)</td>
<td>M 12.12</td>
<td>8.07</td>
</tr>
<tr>
<td></td>
<td>SD 18.39</td>
<td>6.87</td>
</tr>
<tr>
<td>Proposing Question (Q)</td>
<td>M 1.51</td>
<td>7.81</td>
</tr>
<tr>
<td></td>
<td>SD 3.21</td>
<td>6.65</td>
</tr>
<tr>
<td>Answering Question (A)</td>
<td>M 5.30</td>
<td>7.30</td>
</tr>
<tr>
<td></td>
<td>SD 8.00</td>
<td>5.79</td>
</tr>
<tr>
<td>Viewing Peers’ works (V)</td>
<td>M 56.21</td>
<td>65.42</td>
</tr>
<tr>
<td></td>
<td>SD 29.41</td>
<td>13.42</td>
</tr>
</tbody>
</table>

*p<=.05, ** p<.01

By analyzing the percentage of behaviors in each time stage, Figure 1 and Table 2 show us the overall time allocation pattern of the students’ interactive behaviors. In all of the stages, the students mainly focused on viewing others’ work (V). In the middle stage, learners allocated more time to propose questions than early stage, Q.
increased (t [42] =-6.05, p<.01), and V (65.42%) also increased (t [42] =-2.01, p=.05). However, S (11.21%) decreased (t [42] =2.33, p<.05). Then, in the late stage, the frequency of V keep increasing significantly to 81.56% (t [42] =-10.83, p<.01), Q decreased (t [42] =3.67, p<.01), and S keep decreasing significantly to 3.26% (t [42] =5.91, p<.01). Among the all stages, the variations of A and F were not reached statistical significance.

By looking at the time allocation pattern of behaviors in the early, middle, and late stages, we see that the percentage of students’ viewing others works increased and information sharing decreased significantly along with time. This shows that it seems that the students do more data-gathering and share them to peers at their early stages. After more information was gathered, the percentage of information sharing (S) reduced, and they viewed peers’ works (V) more frequently and proposed more questions (Q). Interactive discussion behaviors such as F, Q, and A were occurred more average in the middle stage (each was about 7%–8%).

Past studies pointed that online PBL learners often view online resources as the “answers” to the project without in-depth analyzing [7] [8]. We found that the phenomenon discussed may be reduced when applying the interactive activities appropriately. Because the design of interactive activities in this study required learners to gather and sharing enough information (S), and do more observations (V) before they can participate in behaviors such as asking questions (Q), giving feedbacks (F), or solving questions (S) that are more interactive in the middle stage. This process gradually promotes the students to extend their analytical skills and increases the depth and width of their information analyses as well as interaction during the PBL activity, and the phenomenon in which learners immediately view online resources as answers should be reduced to a certain extent and the effectiveness of PBL may be enhanced.

Moreover, as for the fact that “sharing information” (S) and “proposing questions” (Q) behaviors decreased significantly in the late stages (S was merely 3.26%). We suggest that teachers may intervene at the last stages in order to add in appropriate teaching strategies to guide students to continue to look for more new external information to maintain the quality of analysis or create new questions for knowledge construction (e.g., a teacher posts relevant articles in the forum to stimulate the students to think in new ways and guides them how to look for more supplemental information). On the other hand, the technology of “intelligent agent” that provides personalized and automatic guidance[10] may also be utilized to actively detect the frequency of a user’s interactive behaviors, and analyze the behavior approaches and automatically provide guidance to learners, or provide information for the teachers to indicate what is the appropriate point for intervention. This kind of technology will help to continue to expand and deepen the interaction during online PBL.

4. Conclusion

In this study, we explored the time-management pattern of the students’ interactive behaviors during an online PBL activity without teachers’ intervention. From the pattern, we can see learners collected and shared enough information gradually, and then focus on more interactive behaviors (such as proposing questions) in the middle stages. The process gradually promotes the students to extend their analytical skills and increases the depth and width of their information analyses and interaction during the PBL activity via the interactive activities. Moreover, this study also provides suggestions as references for teachers to continue to expand and deepen the interaction during the latter stages of online PBL.

Finally, we hope to conduct longer observations as well as content analysis focusing on the content of students’ interactions in the future in order to discuss the effects of the pattern at a deeper level.

5. Reference