How the Eighth Grade Students Reused Knowledge

Jui-Chen Yu
National Science and Technology Museum, Kaohsiung 807, Taiwan, R.O.C.
raisin@mail.nstm.gov.tw

Hung-Jen Yang
National Kaohsiung Normal University, Kaohsiung 807, Taiwan, R.O.C.
hungjen.yang@gmail.com

Hsieh-Hua Yang
Oriental Institute of Technology, Taipei County 220, Taiwan, R.O.C.
FL008@mail.oit.edu.tw

Feng-Chung Lin
National Kaohsiung Normal University, Kaohsiung 807, Taiwan, R.O.C.
Sinopac399218@yahoo.com.tw

Abstract

This study used a theory from the field of knowledge management to evaluate the effectiveness of an on-line activity which was implemented in a grade eight class in Taiwan. In this activity, students were asked to search and share related knowledge to design and build a golf ball slide. The result showed that Students were retrieving prior knowledge more frequently than capturing new knowledge. Also, three levels of complexity of knowledge reuse actions taken by students during the activity were found. This study showed a different view on how students learn.

1. Introduction

Learning has been traditionally divided into three domains: cognitive, affective, and psychomotor. To measure how much students learn from each course, achievement tests and attitude scales were developed and implemented in most classrooms and schools. However, things did not always be done like this way in the real world. Knowledge learned need to be used to solve problems or complete tasks.

Today’s students will be tomorrow’s knowledge workers in various kinds of businesses. This study argued that how students use knowledge can be an approach to evaluate students learning. A theory of knowledge reuse developed by Markus [1] was used as a framework for analysis.

2. Review of literature

Many researchers provided their views to define what the knowledge management (KM) is. For example, Na Ubon and Kimble said that “KM is the management of processes that govern the creation, dissemination, and utilization of knowledge by merging technologies, organizational structures and people to create the most effective learning, problem solving, and decision-making in an organisation” [2]. Petrides and Nodine described knowledge management as “a set of practices that helps to improve the use and sharing of data and information in decision-making” [3]. Both articles made all their contributions to the field of education. Especially, Petrides and Nodine emphasized that the ultimate beneficiary of promoting knowledge management should be “students, teachers, and the education community as a whole” [3]. Indeed, it is worthy for us to accept knowledge management as a strategic resource for improving technology education in our schools.

In a study of improvement projects from thirty organizations, Davenport, Jarvenpaa, and Beers discovered five different primary orientations to knowledge: acquisition, creation, packaging, application, and reuse of knowledge. They also defined knowledge reuse process as separating prior knowledge and leveraging it to a greater degree [4].
According to Markus [1], there are four stages in the process of knowledge reuse including capturing or documenting knowledge, packaging knowledge for reuse, distributing or disseminating knowledge and reusing knowledge. Capturing or documenting knowledge involves passive producing from the work process, generating from informal electronic communication or meeting system, creating archives, and filtering and sanitizing knowledge for later reuse. Packaging knowledge consists of different activities such as “culling, cleaning and polishing, structuring, formatting, or indexing documents against a classification scheme.” Distributing or disseminating knowledge includes sending information to the potential users through email alerts or newsletters, and facilitating knowledge reuse activities such as assessing users’ needs or helping them use knowledge. Reusing knowledge is the process of defining questions, seeking and selecting of expert advice, and applying the knowledge in practice.

Markus also clarified three key roles involved in the knowledge reuse process: knowledge producer (who creates and records knowledge), knowledge intermediary (who prepares and processes knowledge), and knowledge consumer (who retrieves and applies knowledge). It is possible for one individual or group to perform these roles at the same time. Also, it is possible to use information technology to perform some of these roles, particularly in dissemination and facilitation of knowledge [1].

3. Design and methods

3.1. Participants

The participated teacher was Ms. Huang who has been teaching Computer and Home Economics in Wu Chia Junior High School, Kaohsiung County for nine years. During the course of this experimental research project, she was studying at the Graduate Institute of Industrial Technology Education, National Kaohsiung Normal University and majoring Technology Education. When the research team approached her and told her about this project, she was willing to take challenge and try something new in her class. A grade eight class was suggested by Ms. Huang to participate this project. The class consisted of eleven girls and twenty-two boys.

3.2. Activity design

The activity was named “Golf Ball Slide Design.” In this activity, students were asked to design and build a golf ball slide by using materials available at home or school. The slide must be no taller than 30 millimeters. After finishing their slides, a competition was held to test which slide can send a golf ball to the furthest distance or the highest place. All students were grouped into six teams. Three teams challenged the furthest distance and the others challenged the highest place.

During the activity, students were required to use four areas of knowledge including science, technology, engineering, and mathematics (STEM). All the information or knowledge found on the Internet or elsewhere need to be shared and used with team members at the web-based platform served through Moodle. How these information and knowledge shared and re-used in the design and making of the golf ball slide served as the assessment criteria. The following steps were developed to guide students through the process:

   Step 1: Define a design goal and identify possible problems
   Step 2: Gather ideas, information, or knowledge and analyze potential solutions
   Step 3: Design and test a prototype, and solve problems
   Step 4: Finish the product and write a description
   Step 5: Participate in the competition

The activity was carried out at the second semester of 2008 school year from February 19 to June 23. The class met every Monday from 14:15 to 15:00 at the computer room and/or the technology lab.

At the end of semester, all six teams finished their design projects. The structure of their slides was similar including a slide and a support at one end of the slide to create a downhill slope. However, materials they used for structures were different including cardboard (Team 1, 2, and 6), cut garden hose (Team 3), corrugated paper board (Team 4), and card paper (Team 5). Most of teams applied oil on the surface of slides to reduce friction, but one (Team 4) used tinfoil.

3.3. Data collection and analysis

Two trained data analysts were assigned to transcribe and analyze the data stored on the web. They were asking to analyze data based on the theory of knowledge reuse proposed by Markus [1]. After finishing analysis process, preliminary findings from both analysts were examined by authors to check on the disagreement and to discuss until reaching the agreement.

4. Findings

4.1. Students were retrieving prior knowledge more frequently than capturing new knowledge

Since the process of knowledge reuse involves in capturing new knowledge and retrieving prior knowledge, this study first examined on that. How many
times each team captured new knowledge and retrieved prior knowledge were identified and documented in Table 1. Based on Table 1, there were two teams (Team 1 and Team 6) involved only in retrieving prior knowledge without trying to find new knowledge for completing designated tasks. Team 4 only tried to capture new knowledge once. On the contrary, they were retrieving a lot of knowledge already knew to use in designing their slides.

<table>
<thead>
<tr>
<th>Teams</th>
<th>Retrieving Prior Knowledge</th>
<th>Capturing New Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team 1</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Team 2</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Team 3</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Team 4</td>
<td>39</td>
<td>1</td>
</tr>
<tr>
<td>Team 5</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Team 6</td>
<td>11</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1. Frequencies of retrieving prior knowledge and capturing new knowledge from each team

4.2. Three levels of complexity of knowledge reuse actions taken by students were found

Actions taken by students after retrieving or capturing knowledge can be classified into three levels based on complexity of these actions. The level one, the simplest one, referred to prior or new knowledge was used directly on the design project without packaging or distributing knowledge beforehand. The level two referred to knowledge was packaged and/or distributed first and then reused on the design project. The level three, the most complex one, meant that the reused knowledge was re-packaged and/or re-distributed again for further reuses.

Level I
Retrieving Prior Knowledge
→ Reusing Knowledge

Level II
Retrieving Prior or Capturing New Knowledge
→ Packaging and/or Distributing Knowledge
→ Reusing Knowledge

Level III
Retrieving Prior or Capturing New Knowledge
→ Packaging and/or Distributing Knowledge
→ Re-packaging and/or Re-distributing Knowledge
→ Reusing Knowledge

How many times each team involved in different complex levels of knowledge reuse actions were analyzed and documented in Table 2. Clearly, actions of re-packaging and/or re-distributing knowledge were less frequently found during the activity. Usually, they were found when students were working on writing descriptions.

<table>
<thead>
<tr>
<th>Teams</th>
<th>Level I</th>
<th>Level II</th>
<th>Level III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team 1</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Team 2</td>
<td>10</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Team 3</td>
<td>4</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>Team 4</td>
<td>13</td>
<td>26</td>
<td>7</td>
</tr>
<tr>
<td>Team 5</td>
<td>7</td>
<td>18</td>
<td>4</td>
</tr>
<tr>
<td>Team 6</td>
<td>4</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>41</td>
<td>65</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 2. Frequencies of different levels of complexity of knowledge reuse actions taken by each team

5. Implications

In this study, two approaches were used to analyze how students learned from this design project. One was to examine how students tried to capture new knowledge to solve problems. The other was to analyze how students processed and reused knowledge. Both approaches can be a means to evaluate students learning. It could provide a different view on students' performance.

Participated students were growing up with computers and the internet. They were used to search information or knowledge on the web and apply them in the daily life. Apparently, some of them did not use that skill on this project. Probably, it was because this project involved academic knowledge which was not familiar to them. They need to be encouraged and upgrade their skills to search and apply new knowledge in academic fields.

6. References


