Effects of Computerized Advance Organizers on Elementary School Mathematics Learning

Chienhsun Tseng, Weichung Wang, Yi-jinn Lin, and Pi-hsia Hung
National Tainan Teachers College, Taiwan, R.O.C.
tjs1219@mail2000.com.tw

Abstract

This study aims to develop and analyze the effects of computerized advance organizers with multimedia. The system design adopts computer multimedia to link three frameworks: mathematics learning, computer mindtools and problem solving. The system also uses examples of students’ daily life to compose two types (with Flash and Powerpoint) of computerized advance organizers. Taking probability as examples, the influences of computerized advance organizers on students’ achievements and retention of learning Mathematics were evaluated. In the experiment involving more than 200 pupils, it was founded that the learning achievements on probability learning of the students who used two types of computerized advance organizers are better than those of students who used none of advance organizers under the computer aided learning system mode.

Keywords: Computerized advance organizers, Mindtools, Mathematics learning achievement, elementary school

1 Introduction

Using computers in classes is an inexorable trend. Shih-Jen Wen (1999) indicated that the education in Taiwan would move toward a scientific and technological stage in the near future, at which the interaction with broadband network, multimedia and virtual reality would be widely applied. However, the dissemination of knowledge via information technology cannot effectively facilitate the cognitive and mind development of learners. Anderson (1999) pointed out that to use network technology in teaching activities, one should focus on whether it changes students’ ways of learning materials, to increase persistence of memory, and to be a better tool for learning. On the other hand, the concept of advance organizers integrates the prior knowledge and teaching materials into a framework of curriculum for future study. Advance organizers also allow students to control their progresses and directions of study.

According to the above-mentioned facts and belief, this paper is intended to achieve the following goals: (1) To develop computerized advance organizers by combining computer and the concept of Mindtools. (2) To evaluate the efficiency of computerized advance organizers with Mathematics learning achievements and retention of learning. (3) To evaluate if it would have differences in students’ learning achievements and retentions of learning under combination of advance organizers of computer with computer aided learning (CAL) environment or traditional teaching mode.

2 Design of computerized advance organizers

We designed two types of computerized advance organizers in this research. Features of the two type computerized advance organizers are shown in Table 2-1.

Table 2-1: Two types of the advance organizers

<table>
<thead>
<tr>
<th></th>
<th>Type one</th>
<th>Type two</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authoring tool</td>
<td>Micromedia Flash.</td>
<td>Microsoft PowerPoint</td>
</tr>
<tr>
<td>Common functions</td>
<td>(1) An outline for new and old curricula in different levels and link them together. (2) The use of spreadsheet as Mindtools to establish prior knowledge. (3) Combination of concrete daily life examples with student’s living experience.</td>
<td>(1) It is easier to be implemented by teachers</td>
</tr>
<tr>
<td>Differences between</td>
<td>(1) Animations display concrete activities. (2) Various multimedia effect problems are used to increases pupils’ problem solving ability</td>
<td></td>
</tr>
</tbody>
</table>

Both two types of computerized advance organizers are designed to achieve the following learning goals. (1) To assist pupils to establish the connections and relationships of the new and old knowledge. (2) To assist
pupils to understand the learning structures of the subjects. (3) To encourage pupils’ interests in problem solving. Besides, we focus on probability in elementary school mathematics as the learning subjects. Both material in the textbooks and students’ living experience are integrated into the system to match up their cognitive process of development in mathematics.

3 Methods and Procedure of the Experiment

Two hundred and seven sixth grade pupils were divided into 2 groups for different learning situations. One was taught by traditional teaching method and the other one was taught by the CAL systems. Each group is further divided into three sub-groups and each sub-group adopts the three different types of computerized advance organizer. Table 3-1 illustrates the grouping strategies. This study adopts quasi-experiment to differentiate the performance of different advance organizers under traditional and CAL teaching methods in pupils’ learning accomplishments and memory retention. The study also collects pupils’ feedbacks regarding the computerized advance organizers.

Table 3-1: Grouping and Structure

<table>
<thead>
<tr>
<th>Group</th>
<th>Type of advance organizers</th>
<th>Number of students</th>
<th>Teaching methods</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Type 1</td>
<td>34</td>
<td>Using the CAL systems of probability (1) Providing learning materials and tools by computer (2) The teacher asks questions, analyzes and holds group discussing</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>Type 2</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td>None</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>Type 1</td>
<td>36</td>
<td>General teaching mode in classes (1) Using Math. textbooks and teaching tools such as dices about probability lessons (2) The teacher asks questions, analyzes and holds group discussing</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>Type 2</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td>None</td>
<td>35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Results and analysis of the experiment

4.1 Analysis of the pretest and the posttest

According to the ANCOVA analysis of the pre-test and the postpone test in Groups A1, A2 and A3, a homogeneity of within-class regression coefficient can be found with all samples \( F = 1.220, p = .300 \). The result shows \( F:2.99=3.515, p<.034 \). The students who used both two types of computerized advance organizers obviously have higher learning achievements than those who used none of computerized advance organizer. Furthermore, according to the ANCOVA analysis of the pretest and the postpone test in Groups A4, A5 and A6, the result shows \( F:2.100 =3.315, p=.048 \). The students who used computerized advanced organizers obviously have higher retention of learning than those who used nothing under general teaching mode.

4.2 Survey of system usage

From the feedback of the Comment Questionnaire, the following feedback can be used as references for further developing the computerized advance organizers revision.

(1) Over 80 percent of the pupils using both two types of the computerized advance organizers considered they are helpful. (2) Over 70 percent of the students wished that their teachers would review the old learned contents or materials and explain what new and learned material would be. (3) The percentage of the students understanding the coming course of learning probability is higher than that of the students knowing clearly about what the question of probability is through the computerized advance organizers. It seemed that the computerized advance organizers were capable of representing the outlines or frameworks of the learned courses.

5. Conclusion

The computerized advance organizers use multimedia to act as a bridge between new learning material and exited related knowledge. They help the learners to develop their super-ordinate representational and combinative processes that occur during the reception of mathematic concepts. Therefore, under the learning model of using computer visual simulated tools as Mindtools, it is remarkable that the students using the multimedia based computerized advance organizers have better learning achievements than those who used none of computerized advance organizers. While the retention of learning of the students who used computerized advance organizers is better under the general teaching mode. Both are not consistent in their learning achievements and retention of learning, it is still worthy to probe further into the efficiency of combination of advance organizers with visual simulated tools of computer.

References