The Development and Study of a Discussion-Based Concept Cartoon System

Huang, Tzu-Hua and Liu, Shuang

***Abstract*—** A concept cartoon presents discussions between cartoon characters on specific concepts in daily life in the form of a comic. This arouses interest among students to participate in discussions and induces systematic thinking. This study combines concept cartoon and learning through discussion into a learning system, and carries out different concept cartoon teaching activities, examining the effect on their achievement, interest, attitude, and anxiety in learning mathematics. Research findings are as follows: Different teaching models using concept cartoon have significantly different effect on students' learning achievement, in which the discussion-based concept cartoon group of students had better performance.

***Keywords*—** Concept Cartoon, Discussion-based, Mathematics Achievement

I. Introduction

At school, problem solving technique is the most important factor in mathematics learning achievement. Meaningful learning and comprehension is the foundation of learning different subjects, and is especially important in the mathematics learning process. Visualized learning plays an important role in learning mathematics, and visual representation often helps with comprehension. The use of visual and graphic representation achieves more effective comprehension, memory of problems, and improvement of mathematics reasoning (Debrenti, 2015). Cartoons and comics have always been viewed as enemies of the school, and students may be punished if they are caught reading comic books at school (Cleaver, 2008). Today, educators are attaching growing importance to cartoons and comics. Some teachers are beginning to view cartoons and comics as potential education tools, and are applying them in teaching to increase students' interest in subjects (Cleaver, 2008). Song (2008) mentioned that cartoons are especially effective to students when used in science-related dialogue. When familiar cartoon characters become the main character in their dialogue, even the quietest students in class can be encouraged to participate in discussions and dialogue. Active dialogue and discussion can help students understand scientific concepts, and can also help teachers understand students' learning condition and progress (Song, 2008). The purpose of using concept cartoons for teaching is neither for entertainment nor is it for students to memorize concepts. It is a teaching method that provides food for thought and develops creativity. Different benefits can be obtained when using cartoons in teaching, such as helping students gain the ability to think, giving them systematic concepts, and increasing their learning motivation (Şengül & Üner, 2010). Visual expressions that are closer to daily life can guide students to use their prior knowledge for more in-depth thinking and more complete concept development (Greenwald & Nestler, 2004). The use of multimedia technology and graphics in concept cartoons allow students to learn in a diversified environment. Akamca, Ellez, and Hamurcu (2009) used computer-aided concept cartoon for teaching a science course, and found that students were able to discover concepts they misunderstood within a short period of time when they were given the opportunity to participate in discussions. This created a good learning atmosphere, and the computer animations and dubbing made students more focused when learning, creating a positive effect on students' learning achievement. Subjects of this study are fifth graders in elementary school in Taiwan. After the teacher finishes teaching a mathematics class, two different types of teaching activities are carried out, specifically concept cartoon and typical teaching activities. The purpose is to ascertain the effect of concept cartoon teaching activities and typical teaching activities on students' mathematics learning achievement.

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II. Method

Research subjects are fifth graders in an elementary school in Taiwan; there are six classes in total. This is so every student has a tablet PC to use as a learning tool. There are 79 subjects divided into three groups; 29 in the discussion-based concept cartoon teaching group; 26 in the traditional concept cartoon teaching group; 24 in the conventional teaching group. Experimental group 1 uses discussion-based concept cartoons for teaching. After the teacher finishes teaching, the teacher reviews math concepts and has students discuss concept cartoons for teaching math concepts. The method of discussion is students first discuss concepts and then choose the concept they believe is correct. Experimental group 2 uses traditional concept cartoons for teaching. After the teacher finishes teaching, the teacher reviews math concepts and uses traditional concept cartoons for teaching math concepts. The teacher first provides concepts in teaching activities using concept cartoons, and then students choose the concept they

believe is correct. The control group uses typical teaching methods without using concept cartons. The teacher reviews math concepts after finishing teaching, and then uses a worksheet to teach math concepts.

Fig.1. Discussion screen of the discussion-based concept cartoon group

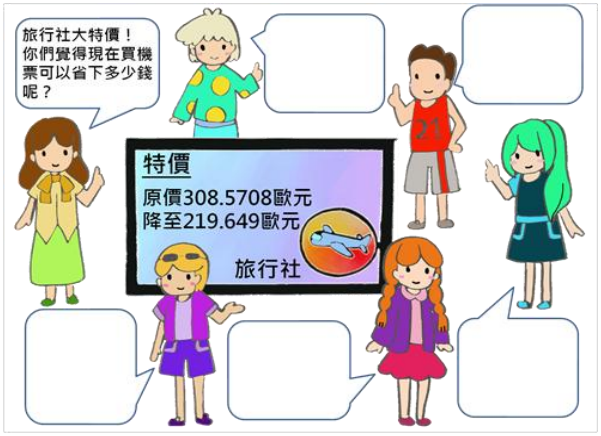

Fig.2. Results screen of the discussion-based concept cartoon group

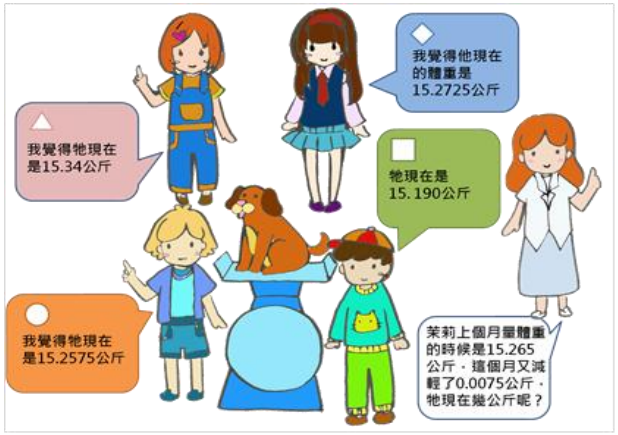

Fig.3. Results screen of the traditional concept cartoon group

III. Results And Discussion

Descriptive statistics of students in Experimental group 1 (discussion-based concept cartoon teaching group), Experimental group 2 (traditional concept cartoon teaching group) and Control group (typical teaching group) in the mathematics learning achievement pretest is first analyzed. In the mathematics learning achievement pretest, the 29 students in the discussion-based concept cartoon teaching group had an average score of 77.10 with a standard deviation of 17.00; the 26 students in the traditional concept cartoon teaching group had an average score of 73.31 with a standard deviation of 18.62; the 24 students in the typical teaching group had an average score of 77.17 with a standard deviation of 16.69. One-way ANOVA results for the pretest are as follows: $F = 0.42$, $p=.66>.05$ did not reach the level of significance, indicating no significant difference in the mathematics learning achievement of students in different groups. Next, descriptive statistics of students in Experimental group 1 (discussion-based concept cartoon teaching group), Experimental group 2 (traditional concept cartoon teaching group) and Control group (typical teaching group) in the mathematics learning achievement posttest is analyzed. In the mathematics learning achievement posttest, the 29 students in the discussion-based concept cartoon teaching group had an average score of 92.83 with a standard deviation of 10.97; the 26 students in the traditional concept cartoon teaching group had an average score of 87.08 with a standard deviation of 12.82; the 24 students in the typical teaching group had an average score of 81.33 with a standard deviation of 16.79. One-way ANOVA results for the posttest are as follows: $F = 4.74$, $p=.01<.05$ reached the level of significance, indicating a significant difference in the mathematics learning achievement of students in different groups. Multiple comparisons are then made to understand the effects of detailed factors. The Scheffe method is used for post hoc multiple comparisons. Experimental group 1 (discussion-based concept cartoon teaching group) and Experimental group 2 (traditional concept cartoon teaching group) were not significantly different; Experimental group 1 (discussion-based concept cartoon teaching group) and Control group (typical teaching group) were significantly different; Experimental group 2 (traditional concept cartoon teaching group) and Control group (typical teaching group) were not significantly different. For Experimental group 1 and Experimental group 2, $p=.30>.05$; for Experimental group 1 and Control group, $p=.01<.05$; for Experimental group 2 and Control group, $p=.33>.05$. Hence, students' mathematics achievement was significantly higher when using discussion-based concept cartoon teaching instead of typical teaching. Students in Experimental group 1 may have performed better because they not only used visualized concept cartoons to comprehend math problems, but also engaged in group discussions, which allowed group members to provide basic information to each other and also share thoughts and opinions. This gave them a clearer understanding of concepts, and resulted in the significantly better learning achievement of Experimental group 1 compared with other groups. This result is consistent with the research finding of Macleod (2009) that

discussion will improve students' learning efficiency and make them more focused when learning math.

IV. Conclusions

According to the findings of the study, students that use discussion-based concept cartoons (Experimental group 1) had significantly better mathematics learning achievement than the other groups. The group discussion allowed group members to provide basic information to each other and also share thoughts and opinions. This gave them a clearer understanding of concepts. The use of a discussion system gave every student the opportunity to speak. Students can leave their thoughts in the discussion area and give answers without any restrictions, resulting in the significantly better mathematics learning achievement of Experimental group 1. Teachers are recommended to provide students with opportunities to actively participate in learning, and interact and exchange thoughts with their peers through discussions. This will inspire students to think, give them their own thought process, and give them more space to think.

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