A Comparative Study of Cooperative and Collaborative Learning on Online Game-styled Learning Systems

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Abstracts

This study attempts to apply two teamwork learning patterns, Cooperative Learning and Collaborative Learning, to the online game-styled computer-assisted learning system. Four units of fourth-grade elementary math are implemented into the games; that students are engaged in. In addition, the study explores whether these two online game mechanisms help students with math studies in a significant way. The study employs the quasi-experiment method to evaluate teaching achievements. Outcomes of the pre-test and post test T-test, as well as variable analysis revealed that the learning achievements of these two approaches are superior to conventional stereotypes. Studies in the correlation between genders and the two learning patterns found that boys are more suitable to participate in collaborative learning while girls act well in both teamwork-learning patterns.

Keywords: Cooperative Learning, Collaborative Learning, Online Game-Styled Learning System
1. Introduction

Many have the impression that as long as a teacher divides students into several groups, panel discussions, and, later, the conclusion considered as team learning. This kind of grouping approach; however, can easily lead to nominal teamwork learning in which more capable students are given more responsibilities while less competent students are relegated to token roles [8]. As a result, more capable students will learn faster than less competent students, and as the vicious circle repeats itself high-achievers will be better and better and low-achievers will only be moving toward the opposite direction [5]. To rectify this problem, we plan to characterize learning methods based on different teamwork learning approaches, bring out effective responsibility sharing and exact cooperation to students, in order to achieve substantial learning objectives...

As described above, the purpose of this study are as following:
1. To engage in four studying aspects: volume, fraction, angle and length.
2. To explore, which learning mode either Cooperative Learning or Collaborative Learning is more helpful in assisting fourth-graders math studies.
3. To examine whether the cooperative environment of online math game enhances students’ willingness and ability, in hopes that research outcomes as a reference for teachers in developing teaching methods.

2. Literature Review

2.1 Definition of Teamwork Learning

The idea of teamwork learning is not new. Since the ancient past there have been scholars advocating the concept of teamwork learning. “Those who study alone without friends tend to be narrow-minded and uninformed,” said Confucius. “Where there are as few as three people, I can find someone to teach me something.” The great philosopher was referring to the fact that the power of self is weak and that the strength and wisdom of every member of the group needs. Palincsar indicates “teamwork learning” is about assigning students to small groups in which they learn through cooperation [10]. Students work together to accomplish the objective. Through discuss, interact with each other, encourage separate criticisms, adjust the point of view, all the students of each group can learn the designated materials. Teamwork learning is the essential component of constructivism. It is a concept of teaching design that encourages students to continue to discuss with others and exchange opinions with others in the learning process in order to construct knowledge that is meaningful to the students [7].

2.2 Categories of Teamwork Learning

There have been numerous studies on teamwork learning, yet few have attempted to define the category of teamwork learning. In terms of two learning methods, cooperative learning and collaborative learning collectively refer to cooperative learning, but has differences of original meaning. The following is a brief explanation of the two types of teamwork learning. Cooperative Learning: Cooperative learning is often applied to group learning. Through group discussions students solve the problems [3]. In group learning of uneven task distribution, responsibility sharing is often relegated to mere formality possibly because of the fact that high-achievers for fear of being slowed down by the low-achievers choose to
attain the goal alone that is meant for group completion and thereby deprive teamwork learning of its meaning. Conversely, it is also possible that in order to evade heavy responsibility high-achievers will purposely hide their ability and shift the burden to others. To avoid this situation, we need to separate “team learning” from “cooperative learning”. “Cooperative learning” means every student of the team to assume the responsibility of accomplishing a part of the learning objective. Every part is equally important. It requires all to pool their efforts together in order to accomplish the mission of the team. That is genuine cooperative learning [1]. Johnson & Johnson believe cooperation is a relationship of reciprocal assistance that requires individual responsibilities. Every member of the group needs to learn and develop communication skills and makes decisions through communication and mutual trust [6].

Collaborative Learning: This is clearly a social process among group members who could adopt various strategies for resolving differences including asserting dominance, acquiescing, or some form of reciprocal sense making. An important aspect of collaborative learning is the move from assimilation to construction [9]. Collaborative learning in practice, therefore, is allowing a group of learners to explore learning problems through active interaction and remove these problems [4]. In this type of teamwork learning, there is no clear distinction between the role of a teacher and that of a student. The conventional teaching approach is not followed. No longer is a knowledge provider, the teacher there to give students guidance. No specific responsibility-sharing structure is prescribed. Through interactive discussions, all learners work together to establish consensus on learning objectives and solve common problems. The classroom is not the only place where collaborative learning takes place. The practice can be expanded to the entire society. Any place that allows learners to discuss and work with one another is appropriate for collaborative learning. In essence, collaborative learning researchers tend to employ the method of constructivism. So collaborative learning is in line with the approach of the “constructive teaching method” [2]. Whipple presents the following characteristics of collaborative learning: In the process of education, both the counsellor and the learner are active participants. There is no hierarchical difference between the counsellor and the learner. The group consensus needs to be established. Knowledge is constructed not directly transmitted. Knowledge is positioned as one of the five fundamental essences including the group [11].

3. Research Design and Method

3.1 Research Framework

This study evaluates teaching achievement mainly through the quasi-experiment method. Before the experiment, both the experiment group and the control group received the pre-test on “the four math units of the Fall Semester of the Fourth Grade”. The four-week experimental teaching followed. After the experiment concluded, they received the posttest on “the four math units of the Fall Semester of the Fourth Grade”. The design of the experiment is shown in Table 1:
Teams | Pre-test | Handling of Experiment | Post-test |
---|---|---|---|
First Experiment Team | X | X1 | X2 |
Second Experiment Team | Y | Y1 | Y2 |
Control Team | Z | Z1 | Z2 |

Table 1: Brief Table of Experiment Design

X, Y, Z: both experiment team and control team take Pre-test.
X2, Y2, Z2: both experiment team and control team take Post-test.
X1: “Cooperative learning of online math games” is used by First Experiment Team to support math learning.
Y1: “Collaborative learning of online math games” is used by Second Experiment Team to support math learning.
Z1: Control Team uses traditional learning method

3.2 Cooperative Learning Interface

On the server-end screen there are three options including “those who have not form teams”, “teams that have been formed” and “teams that are calling” as shown in Figure 1. It is designed to enable the researcher to stay on top of student activities. On the user-end screen, the researcher designed a few control choices including the mechanism to call partners for team organization, the pull-down menu for selection of answers, the discussion mechanism for cooperative learning, and the teacher’s feedback when a wrong answer is given (see Fig. 2). In this system, the questions are provided dynamically from the databank for the two students of each team to answer the two-step math questions with the one writing down the first step and the other writing the second step and the final answer.

![Fig 1. Cooperative Learning Server-End Screen](image-url)
3.3 Collaborative Learning Interface

On the server-end screen, the researcher can easily engage in question discussed with the students. The questions are provided dynamically from the databank, but the researcher in accordance with the students’ status can present questions any time to give guidance. Staying fully aware of the students’ activities, the researcher can intervene to provide assistance as shown in Figure 3. On the user-end game screen, the researcher designed a discussion screen similar to that of the server-end as shown in Figure 4. The main difference lies in the fact that the user-end interface has a common “vocabulary selection” button, which helps reduce typing difficulties and enhances students’ confidence. Through the assistance of the number buttons, students are able to present the math expression in its entirety in the discussion zone for interaction with other learners and for completion of the question.

The number of people online
4. Research Outcomes and Discussions

4.1 Analysis of the two types of teamwork CAL on math teaching achievements of the classes

According to Table 2, we have learned that the pre-test scores of the experiment group and the control group have not reached the significant level, so we can say there is no discrepancy between the two groups. According to the experiment framework, independent sample ANOVA is employed for the post test. Post test data analysis reveals the differences between the two experiment groups and the control group reach the significant level as shown in Table 3. Yet post-event analysis shows the difference between the two experiment groups has not reached the significant level as shown in Table 4. Experiment outcomes indicate the two CAL teamwork models are significantly superior to the traditional teaching approach.

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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<tr>
<td>Between Groups</td>
<td>519.97</td>
<td>2</td>
<td>259.99</td>
<td>.67</td>
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<tr>
<td>Within Group</td>
<td>33642.53</td>
<td>86</td>
<td>391.19</td>
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<tr>
<td>Total</td>
<td>34162.50</td>
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Table2. Pretest ANOVA

<table>
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<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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<td>1579.82</td>
<td>3.22</td>
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<td>Within Group</td>
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<td>Total</td>
<td>45298.44</td>
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</table>

Table3. Posttest ANOVA
Table 4. Post-Event Comparison of Posttest ANOVA Pairwise Comparisons

Based on estimated argental means
* The mean difference is significant at the 0.05 levels.
a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

4.2 Covariance Analysis of Gender and Online Math Cooperation Models

The analysis indicates boys who participated in the collaborative model obviously outperform boys who went through the conventional teaching approach (p=0.05<0.05). The mean score of the cooperative model is higher than that of the conventional teaching approach, but not by significant margin (Table 5). The result proves that through the collaborative model boys can make more significant progresses than their counterparts who go through the conventional teaching approach.

Table 5. Posttest Analysis Paired Comparison of Boys of Different Teaching Models Pairwise Comparisons
Dependent Variable: Posttest
Based on estimated marginal means
*. The mean difference is significant at the .05 level.
a. Adjustment for multiple Comparisons: Least Significant Difference (equivalent to no adjustments.)

Girls who participated in the cooperative model obviously outperform girls who went through the conventional teaching approach (p=0.004<0.05); girls who participated in the collaborative model also obviously outperform girls who went through the conventional teaching approach (p=0.003<0.05); yet the difference between the cooperative model and the collaborative model is not significant (p=0.333>0.05) as shown in Table 6. It proves that the learning achievement of girls going through cooperative CAL or collaborative CAL is better than that of those going through the conventional teaching approach.

<table>
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<tr>
<th>(I)</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval for Difference</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
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<td>2</td>
<td>16.51*</td>
<td>5.48</td>
<td>.00</td>
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<tr>
<td></td>
<td>3</td>
<td>-1.90</td>
<td>5.35</td>
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<td>18.41*</td>
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</table>

Table 6. Posttest Analysis Paired Comparison of Girls of Different Teaching Models Pairwise Comparisons

Dependent Variable: Posttest
Based on estimated marginal means
*. The mean difference is significant at the .05 level.
a. Adjustment for multiple Comparisons: Least Significant Difference (equivalent to no adjustments.)

5. Conclusions

This study incorporates cooperative learning and collaborative CAL with elementary level math and allows two classes students participating in two types of cooperation. Following four weeks of game process, a data bank is employed to collect students’ basic data in conjunction with analysis of students’ pre-test, and post test scores and online survey questionnaires. In accordance with research objectives and the problems to be solved, this study analyzes “Learning Achievement of Different Classes”, “Learning Achievement of Different Genders” as follows:
5.1 Learning Achievement of Different Classes

According to data analysis of this experiment we can prove that achievements of students who learn through cooperative CAL or collaborative CAL is significantly superior to that of the control group for which conventional teaching approach is employed. Yet the difference between the two has not reached the significant level. Thereby, we can say in the field of information-blended teaching, employment of cooperative CAL or collaborative CAL in math education is equally outstanding.

5.2 Correlation of Genders and Cooperative Patterns

Collaborative CAL is more suitable for boys. Data analysis indicates the collaborative CAL math games through online games; the boys outperform their counterparts that went through conventional teaching approaches. Their average score is also better than that of the cooperative learning pattern. Therefore, we can prove that boys are more suitable for collaborative CAL math games.

Both cooperative CAL and collaborative CAL are more suitable for girls: Data analysis indicates cooperative learning or collaborative learning through CAL online math games, the girls outperform their counterparts who went through conventional teaching approaches. Therefore, we can prove that girls are suitable for both cooperative learning and collaborative CAL math games.

References

