The Exploration of Motivation and Academic Learning in Game-based Learning

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Abstract—Motivation is a very important factor for elementary school students in learning. Using computer games is one of very effective ways to increase students’ motivation when learning domain knowledge. While too focusing on gaming activities may cause the main domain knowledge acquisition. This study mainly explored the effect of motivation and reasoning ability of game based learning in elementary school students. The results show that children get the high motivation but not reasoning in game based learning. Several suggestions are proposed for the future instructional design in game based learning.

Keywords—Motivation; Reasoning; Problem-solving; Game Based Learning

I. INTRODUCTION

Recent studies have shown that Self-directed learning (SDL) is considered to be a core concept of Problem-based learning (PBL).[17] Therefore, it’s seems to enhance the children’s problem-solving ability by designing the SDL teaching plan. The key factors of SDL are that whether students have the responsibility and independence in its own learning process and be able to “manage” their own learning.[16] In addition, when the children contacted the knowledge has never been studied, it may be very difficult to perform the SDL. In order to achieve the above targets at this stage, it seems to be able to drive students continue to participate in SDL mode of learning by enhancing children’s motivation. And computer games are a very popular entertainment in recent year, it seems to be a viable model of assisted learning through computer games high participation characteristic.

However, Tsai and others study indicated that, it probably the students often have a high motivation to learn and affect the learning with the domain knowledge, particularly in subject learning, it's often accompanied by a lot of reading material.[18] In addition to the inner motivation to support children continue learning, how to get domain knowledge through the learner's self-construction in order to get true learning, but also one cannot be ignored major issues. Therefore, this study was to explore the implementation of the game based learning, the connection between motivation factors and curriculum knowledge. At the same time, we made game-based learning instructional design and about it's suggestions.

A. Motivation

Computer game software development, most of all belongs to the scope of entertainment. Whether children or adults, are affected by this a shot in the multi-media games, so if we can use the characteristics of computer game to attract children to use and let it import computer courses, that is worth exploring to understand the actual situation of computer course’s student’s learning motivation and reasoning ability to strengthen. Therefore, in this study, we will integrate computer games into a computer course and propose a teaching strategy, to understand what the primary school children in the acceptance of such teaching strategies is, and understand its motivation and reasoning ability benefit status. After that we can serve as a future follow-up teaching and research related to the reference.

B. Research Framework

The following is the research design model.

TABLE 1. RESEARCH DESIGN MODEL

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest</th>
<th>Experiment</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>O1</td>
<td>X1</td>
<td>O2</td>
</tr>
<tr>
<td>Experimental</td>
<td>O3</td>
<td>X2</td>
<td>O4</td>
</tr>
</tbody>
</table>

O1, O3: The tests before experiment.
X1: Experiment (Problem based teaching strategy).
X2: Experiment (Computer gaming teaching strategy).
O2, O4: The tests after experiment.

C. Research Questions

The related research questions of this current study are below:

1. Whether the elementary school students were enhanced motivation through the computer course work after the computer game-based learning?
2. Whether the elementary school students academic knowledge (reasoning ability) it was enhanced or not after the game-based Learning?
3. What is the relationship between the elementary school students learning motivation and academic knowledge (reasoning ability)?

II. LITERATURE REVIEW

A. Learning Motivation

Learning motivation is a process of achieving learning objectives that the teacher's guide to complete its learning task constantly according to the characteristics and needs of children’s learning process, and in order to maintain children's learning motivation, so that teaching activities can continue to forward.[10] Students are the main characters of Knowledge Learner, when students interested in his / her learning materials and content, they would be paid more attention and serious thought for the learning materials. After study carefully, children may be able to learn more and put knowledge stored in long-term memory. Then we expected it can help us construct knowledge and concepts.[20] This shows that the learning motivation plays an important role of individuals.
In addition, a successful teaching must also pay attention to guiding students inspired and creative thinking skills. In other words, we must guide the children take the initiative in active pursuit of knowledge, a step by step from the external sensory stimulation-induced motivation into the inner motivation of the active pursuit of knowledge. However, to stimulate student's learning motivation, more than or less will affect the learning effect on children. High motivation often results in the high error rate and low motivation leaving the effectiveness learning.[9] Therefore, how teachers in their teaching activities in moderate to stimulate student's learning motivation, they become teachers teaching activities in the important issue of the topics.

B. Reasoning Faculties

"Reasoning faculties" is a high-level cognitive thinking skills. It can help us clarify the facts, and prediction and understanding of the future events. [19] And it also frequently used way of thinking during the scientific inquiry process. [3]

When we carry out a synthesis, analysis or reasoning work, children could be made the information collected, analyze, compare and experiment, then inconsistent with the rules of exclusion or modification of the present assumptions. Thus, in order to seek out a reasonable inference rule as a basis for. Such a series of cognitive, operation processes is, working memory (central integration processes, voice loop area, visual-spatial temporary storage area) Working memory plays an important role in.

The crucial factors are whether children can analysis, integration, induction, in order to form an effective reasoning and problem-solving abilities. [1]

However, for the elementary school children, it is time during the period of constructing their knowledge, and experience the world. When the working memory start sprocesing, how to trigger the old knowledge, experience is an important issue. Sometimes with the teacher or classmates' help, it may be the important key that affected the children further thinking, formed the core concept or successful problem-solving.

In summary, to develop the comprehensive induction, reasoning or analysis skills, it must be in a complex situation and let the children take the initiative to experience, construct concept. However, it seems slightly less than that only create a problem-solving situation, or for the maintenance of student motivation to learn. And it is a feasible method that to implement the game-based learning, to stimulate the children's inner motivation, so that children can continue to search for context or sum up the principles in a complex problem situation.

C. Computer Games

Computer gaming is a kind of activities that combined the skills and cognitive characteristics. It must be very fast and accurate perform a number of operational skills during the process of playing the computer games. Finally, the children reached a goal of the game. During this process, students must find certain rules, and to summarize the crucial factors, then they followed next step by practicing the difficulty skills, in order to achieve a higher level.

In addition, enjoy the game process itself is a place where students should focus on. Sometimes it is not important whether to achieve the goal of the game, because there is no external requirement forced to achieve the goal when children play games. When it is not important to achieve the goal of the game, so that would virtually reduce the pressure to children, but can swim freely in the game world. [5] [15]

It has the following features of computer games: goals and rules, competition and challenge, fantasy and imagination. If we applied the above-mentioned features and appropriately used it in teaching, then we can observe the learning of students. According to some feedbacks from children, we could make an appropriate adjustment in teaching, so that children can keep a balance between the concentration and learning motivation. Finally we could reach the objective of teaching.

It's often used the "competition" designed to enhance student's motivation. In order to let the "competition" bring more benefits, and reduce adverse effects of it, we could use the "cooperation" strategy. Online Game is the best platform that we can play with "cooperation".

In the educational field, teachers could participate in together with students, and apply the features of computer games for the game-based learning, so as to enhance the learning motivation. When finished the game, children are a winner, they might feel happy and have a sense of accomplishment. It would drive them to challenge more difficulty games. In other words, it's the cycle of mutual encouragement of "Challenge" and "sense of accomplishment". Through winning the game to enjoy the sense of accomplishment, then children could learn new knowledge or skills constantly, so as to solve the current problems. Finally, enable them initiative to participate in the Game-based course and achieve learning objectives.

It could have the potential effects of computer games for the development of cognitive learning of children. [4] Greenfield (1984) is considered that the puzzle game not only enhance the induction skills but also the hand-eye coordination, visual ability to transform, etc. If we want to make our children able to put into the game world, it is very important when teachers designed the game-based learning environment. Not only the key point of taking the initiative to learn and how to think, but also related to the whole effectiveness of learning. [6] [13]

Therefore, Game-based learning courses are helpful for enhancing the learning motivation, interest, concentration of children.[12] Many researchers also have shown that teachers could enhance the cognitive ability to synthesize, hand-eye coordination, spatial perception of children during the game-based learning courses. Furthermore, it could reduce the pressure or the feeling of anxiety in children. [11] [2] [8] [14] However, that could be influenced by the high motivation of children. In other words, children who indulged in the process of games, they could also ignore the learning at the same time. [18]

In summary, this study mainly is exploring the computer games into the elementary computer courses then to evaluate the effects of learning motivation and reasoning ability of children.
III. EXPERIMENT PROCESS

A. Methodology

The research subjects were four classes selected from the sixth grade students in Taichung Municipal Cheng-Chung Elementary School. The selection of these two classes was based on similar average scores on Chinese and Math from the second term of the fifth year. Before the experiment, the subjects were tested with the scalogram of Computer Science Learning Motivation and Raven’s Standard Progressive Matrices. Afterwards, students were lectured with six-week computer gaming experimental teaching, observed, recorded and analyzed their learning and interactive behavior on Moodle platforms in order to explore the changes of their abilities in computer science learning motivation and inductive reasoning.

B. Developed Tool

1) Computer Science Learning Motivation Scalogram for 5th and 6th Grade Students of Elementary Students

The scalogram adopted Likert’s Five-Point Rating Scale with 36 items. Its validity was examined by two professors in Instructional Technology in the National Taichung University. Its reliability was examined by the pretest of 52 graduating students from the researcher’s school. The following is the Cronbach’s α.

### TABLE II. THE RELIABILITY OF THE SCALOGRAM IN COMPUTER SCIENCE LEARNING MOTIVATION

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Attention</th>
<th>Relevance</th>
<th>Confidence</th>
<th>Satisfaction</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>0.63</td>
<td>0.53</td>
<td>0.57</td>
<td>0.77</td>
<td>0.89</td>
</tr>
</tbody>
</table>

The above factors show that the scale reliability is from 0.53~0.77 and the total scale is 0.89 which indicate a high reliability for this research. As for the validity, the expert validity is adopted. The validity of the learning motivation scalogram was approved by two of the professors in Instructional Technology from National Taichung University and three senior teachers in Computer Science from elementary and junior high.

2) Raven’s Standard Progressive Matrices (SPM)

Raven’s SPM is the test for inductive reasoning by this research. For the reliability, the internal consistency reliability is 0.97~0.99. The split-half reliability for Taiwan is 0.50~0.93. The test-retest reliability of 4 weeks for Taiwan is 0.53~0.92. Such high reliability shows a high stability. The above factors of Raven’s SPM have sufficient reliability for the cross-cultural tests in non-language graphical reasoning intelligence. For more preciseness in validity and more explanatory power in the data, the scalogram was examined and confirmed by two of the professors in Instructional Technology from National Taichung University and three of the senior teachers in Computer Science.

IV. DATA ANALYSIS

A. Background of Learners

The research subjects were six-grade pupils of four classes selected from the same school. The selection was based on the similar average scores in Chinese and Math on the second term of the fifth grade. The experimental group was computer game learning; the control group was a regular learning group. The following is the summary of research subjects.

During the experimental teaching, pupils were often asked to read experimental instructions. Their reading comprehension and logical thinking usually affects their learning. The scores in language and math and graphical reasoning of research subjects were examined by t-test which the summary was listed in the following table.

### TABLE III. SUMMARY OF RESEARCH SUBJECTS

<table>
<thead>
<tr>
<th>Groups</th>
<th>Boy</th>
<th>Girl</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>6-2</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>6-7</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>Comparison</td>
<td>6-8</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>6-9</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>60</td>
<td>124</td>
</tr>
</tbody>
</table>

From Table 4, the average of Language for the experimental group is 89.78; the standard deviation is 8.29; the average of Language for the control group is 90.98; the standard deviation is 6.75; the it is .863; p is .263, which is not significant (p=. 263>. 05), showing there are not significant statistical differences in Language between the two groups. The language abilities of the two groups before an experiment can be viewed as no different. That is to say the abilities of starting point in Language for the two groups are homogeneous.

The average score of math for experimental group is 84.28; the standard deviation is 12.24; the average score of math for the control group is 84.75; the standard deviation is 12.23; it is .208; p is .977, which is not significant (p=. 977>. 05), showing there are not significant statistical differences Math between the two groups. The math abilities of the two groups before an experiment can be viewed as no different. That is to say the abilities of starting point in Math for the two groups are homogeneous.

For further understanding of the reasoning abilities of the two groups before the experiment, their Raven’s SPM was t-tested. For the t-test summary in the Raven’s SPM pretest, there were totally sixty items. Pupils’ scores were converted to percentile ranks. The highest score was 99. From the table, the average score of pretest for the experimental group is 53.78; the standard deviation is 23.155. The average score of pretest for the control group is 57.73; the standard deviation is 22.707, it is .956; p is .992, which is not significant (p=. 992>. 05), showing there are not significant statistical differences between the two groups. The reasoning abilities of the two groups before an experiment can be viewed as no different. That is to say the abilities of starting point for the two groups are homogeneous.
B. Analysis in Learning Motivation before and after Teaching of Pupils with Computer Gaming Teaching Strategy

This section explores the differences in Computer Science learning motivation of pupils after the computer gaming teaching strategy. The independent variable was different teaching approaches (computer gaming teaching strategy for the experimental group; regular teaching strategy for the control group); covariate was pretest; dependent variable was the posttest. The single-factor analysis of covariance was proceeded. The following table shows the Levene’s test in homogeneity of variance.

**TABLE V. SUMMARY OF LEVENE’S TEST OF HOMOGENEITY OF VARIANCE FOR THE TWO GROUPS**

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>12222.739a</td>
<td>2</td>
<td>6111.369</td>
<td>41.975</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>6362.252</td>
<td>1</td>
<td>6362.252</td>
<td>43.698</td>
<td>.000</td>
</tr>
<tr>
<td>Pretest</td>
<td>9789.595</td>
<td>1</td>
<td>9789.595</td>
<td>67.239</td>
<td>.000</td>
</tr>
<tr>
<td>Class</td>
<td>1114.532</td>
<td>1</td>
<td>1114.532</td>
<td>7.655</td>
<td>.000</td>
</tr>
<tr>
<td>Error</td>
<td>16015.456</td>
<td>110</td>
<td>145.595</td>
<td>.873</td>
<td>.364</td>
</tr>
<tr>
<td>Total</td>
<td>1724557.000</td>
<td>113</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>28238.195</td>
<td>112</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a. R Squared = .433 (Adjusted R Squared = .423)

From Table 5, the Levene’s test of homogeneity of variance is not significant (F=1.130, p=.255>.05), showing the slopes of regression lines can be viewed as the same. The variances of the Computer Science learning motivation for the two groups are compliant with homogeneity assumption. Therefore, “assumption of equal variance” was adopted to proceed the covariance test which the results are shown below.

**TABLE VI. SUMMARY OF COVARIANCE ANALYSIS OF LEARNING MOTIVATION TEST FOR THE TWO GROUPS**

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>59988.983a</td>
<td>2</td>
<td>29994.491</td>
<td>58.734</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>859.138</td>
<td>1</td>
<td>859.138</td>
<td>1.682</td>
<td>.197</td>
</tr>
<tr>
<td>Pretest</td>
<td>58138.005</td>
<td>1</td>
<td>58138.005</td>
<td>113.844</td>
<td>.000</td>
</tr>
<tr>
<td>Class</td>
<td>434.518</td>
<td>1</td>
<td>434.518</td>
<td>.851</td>
<td>.358</td>
</tr>
<tr>
<td>Error</td>
<td>60260.307</td>
<td>118</td>
<td>510.681</td>
<td>.197</td>
<td>.197</td>
</tr>
<tr>
<td>Total</td>
<td>395588.000</td>
<td>121</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>120249.289</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a. R Squared = .499 (Adjusted R Squared = .490)

To further understand the differences in reasoning abilities after “regular teaching strategy” and “computer gaming teaching strategy”, this research adopted a teaching strategy (classes) as independent variable, posttest scores of Raven’s SPM as dependent variable, pretest scores of Raven’s SPM as covariance, to proceed the test of homogeneity of regression coefficients. If the results show homogeneity, single-factor analysis of covariance will go on. Table 8 shows the statistics of Levene’s homogeneity of variance.

**TABLE VIII. SUMMARY OF LEVENE’S HOMOGENEITY OF VARIANCE OF RAVEN’S SPM**

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of pupils</th>
<th>Pretest, posttest</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>59</td>
<td>Pretest</td>
<td>53.73</td>
<td>22.707</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Posttest</td>
<td>51.71</td>
<td>32.607</td>
</tr>
<tr>
<td>Experimental</td>
<td>62</td>
<td>Pretest</td>
<td>53.78</td>
<td>23.155</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Posttest</td>
<td>43.89</td>
<td>30.496</td>
</tr>
</tbody>
</table>

Based on Table 8, Levene’s homogeneity of variance of the two groups is not significant (F=.055, p=.816>.05), showing the slopes of regression lines can be viewed as the same. The variances of the Computer Science learning motivation for the two groups are compliant with homogeneity assumption. Therefore, “assumption of equal variance” was adopted to proceed the covariance test.

**TABLE IX. SUMMARY OF COVARIANCE ANALYSIS OF RAVEN’S SPM**

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
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<tr>
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</tr>
<tr>
<td>Corrected Total</td>
<td>120249.289</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a. R Squared = .499 (Adjusted R Squared = .490)

Single-factor analysis of covariance was proceeded with the results of a group test of homogeneity of regression coefficients. Table 6 shows the independent variables (teaching strategies) performed significant differences on the dependent variables which the F is 7.665 showing there are significant differences in the scores of posttest with the different experiments (independent variables). From the results of single-factor analysis of covariance, there are statistically significant levels (F=7.655, p=0.007<0.05), rejecting the null hypothesis and accepting the alternative hypothesis. Therefore, the learning motivation of the “computer gaming teaching” model (experimental group) is potentially superior to that of the “problem based teaching” model (control group).

C. Analysis of the Reasoning Ability of Pupils before and after Computer Gaming Teaching Strategy

This section explores the differences in pupils’ reasoning ability after the computer gaming teaching strategy. The descriptive statistics values of the pretest and posttest of the two groups are displayed in Table 7. There are total 60 items. After converting to percentile ranks, the highest score is 99. The pretest score of the experimental group is higher than that of the control group (53.78>53.73) but the gap is very small. Contrarily, the posttest score of the control group is higher than that of the experimental group (51.71>43.89). For standard deviation, the scores are more scattered after experiment than before. Furthermore, control group is more scattered than the experimental group (32.607>30.496)
Based on the results of the group test of homogeneity of regression coefficients, single-factor analysis of covariance was carried out. Table 9 shows the effects of independent variables (teaching strategies) on the dependent variables are not significant ($F=.851$, $p=.816>.05$), showing that different experiments (independent variables) did not cause significant differences on the scores of posttest.

The results of single-factor analysis of covariance test show that the posttest scores of the two groups did not reach the statistically significant level ($F=.851$, $p=.358>.05$) and accordingly the null hypotheses were accepted. That is to say it is accepted that there are not significant differences in the learning achievement of reasoning ability between the “computer gaming teaching (experimental group)” model and the “problem based teaching (control group)” model.

D. Analysis of Pupils’ Reasoning Thinking for Each Game

Game 1: Amazing Color Balls

This game is not difficult for pupils. It emphasizes pupils’ sharp-eyed and quick-moving reaction. Not until difficult stages do pupils need strategies to judge which group of color balls has the crisis of falling into the pit and to eliminate that group first.

Game 2: KAWAI Matching Game

Analysis of the pupils’ reasoning process of operating this game:

1. Pupils do considerations when eliminating the same sets of cards.
2. Pupils need to reduce the interference of irrelevant messages on the board.
3. Pupils need to consider the whole distribution of card sets on the board.
4. The reasoning strategies that pupils acquire after eliminating various card sets: the ability to hand-eye coordination, the strategy to reduce the interference of irrelevant messages, the speed in determining strategies and thinking in strain, the control of order in eliminating card sets.

Game 3: The Ice Tower

Analysis of the pupils’ reasoning process of operating this game:

1. To think the order of pushing ice cubes.
2. To prearrange the position stopping the back pushing ice cubes.
3. To consider how to put out all of the flames with limited ice cubes.
4. To make use of the auxiliary means on the board to put out a fire.
5. The figure that pupils operate also performs the function of stopping ice cubes.
6. To operate with reverse thinking as assistance in considering where the ice cubes should stop putting out a fire.
7. To dodge or purge barriers so as to move ice cubes to some certain location.
8. Pupils need to consider whether the assistant gangplank that move or turn ice cubes could be the ultimate key to put out a fire.
9. To take advantage of some certain features of ice cubes so as to put out a fire most efficiently.
10. To timely stop ice cubes from keeping on generating barriers.
11. To find the key clues to cracking the stage when pushing away the layers of hindering ice cubes.
E. Analysis and Discussion on Pupils’ Cooperative Learning in the Computer Gaming Learning Group

Pupils usually encounter difficult stages when operating computer games. In addition to alternate different operating strategies, the most direct solution would be asking the classmates at the side for help. They do not often discuss games in on-line Moodle chat rooms. However, they would use the chat rooms to discuss their daily life and to express their emotions. There seem to be potential benefits to pupils’ learning.

During the discussion in Moodle on-line chat rooms, only a very few pupils would do personal attack, mostly filthy language. This usually made team members displeased and unable to get into a discussion. Once the team members lose common faith or goal, meaningful discussion or consideration would be hardly produced. To facilitate team members’ discussion, the research added discussion training programs to the experiment and lectured, demonstrated about how to discuss in order to guide pupils to discuss more efficiently. After discussion training programs, the researcher observed that there was less personal attack in the chat rooms. But, pupils still did not discuss class contents eagerly.

Due to the definite discussion subjects and patterns, pupils’ discussion and feedback are all relevant to the theme. During group discussion on games, pupils were highly devoted.

Group members cooperated to finish designated tasks. Analysis of the retrieved discussion records showed most groups finished discussion tasks about games. Those unfinished groups were due to the insufficient team members with large amount tasks but they did all they could to finish the group records.

Pupils actively searched the internet for data relating to the games. Take the Game 3: The Ice Tower as an example, after the instruction of this game, the teacher did not tell pupils how to finish each stage but ask them to practice and operate more with the instruction of this game, the teacher did not tell pupils how to finish each stage but ask them to practice and operate more. Take the Game 3: The Ice Tower as an example, after the instruction of this game, the teacher did not tell pupils how to finish each stage but ask them to practice and operate more. Take the Game 3: The Ice Tower as an example, after the instruction of this game, the teacher did not tell pupils how to finish each stage but ask them to practice and operate more. Take the Game 3: The Ice Tower as an example, after the instruction of this game, the teacher did not tell pupils how to finish each stage but ask them to practice and operate more. Take the Game 3: The Ice Tower as an example, after the instruction of this game, the teacher did not tell pupils how to finish each stage but ask them to practice and operate more. Take the Game 3: The Ice Tower as an example, after the instruction of this game, the teacher did not tell pupils how to finish each stage but ask them to practice and operate more. Take the Game 3: The Ice Tower as an example, after the instruction of this game, the teacher did not tell pupils how to finish each stage but ask them to practice and operate more. Take the Game 3: The Ice Tower as an example, after the instruction of this game, the teacher did not tell pupils how to finish each stage but ask them to practice and operate more.

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V. Conclusion

In this study, we have the following conclusions:

A. There Is Statistically Significant Difference between Experimental and Comparison Group in Learning Motivation

That could more easier to provide students opportunities for competition and cooperation with game-based learning environment. Children are better able to trigger the internal psychological reaction by using computer games. In other words, it is helpful for students to enhance their learning motivation, interest and concentration. Therefore, when we used the computer games into the learning environment, it seems potentially useful for a closer friendship between teachers and students, reviving the teaching interaction and achieving the purpose of teaching.

B. After Experimental Teaching, the Score of SPM Test Was Lower than the Pre-test

We speculated that the reason may be children couldn't have concentrated on their work during the reasoning tests so that made some mistakes. This seems to be confirmed it could produce some mistakes and low efficiency when children have a high motivation. On the other hand, when children have a low motivation, it will result in lower productivity. [9] Therefore, we should pay more attention to our children when they play computer games. And prevent them from over-indulging in their own manipulation of computer games, instead of ignoring the course content. It’s also the key point we should further explore in the future.

C. Game-based Teaching Program Still Has to Be Improved

In this study, we found some factors that support children to learn. However, it seems that high motivation will affect children's learning. On the contrary, low motivation led to low productivity. Therefore, if we are able to in-depth and extensive discussions on Game-based learning, it could have the potential effect of learning which enhance academic knowledge of children, even if the teacher and children discuss with each other by using a variety of games-based courses. From the comparison process, how to stimulate students thinking or finding the high level knowledge of game-based curriculum content, it seems to be continuing to research more in the future.

REFERENCES


