World Conference Education Science 2009

The investigation of the effect of simulation based teaching on the student achievement and attitude in electrostatic induction

Ersen Çığrik*, Remziye Ergül

Davut Dörtçelik Elementary School, Bursa, 16200, Turkey
Ulludağ University Elementary Education Department, Bursa, 16120, Turkey

Received October 20, 2008; revised December 11, 2008; accepted January 02, 2009

Abstract

New software have been developed in educational environments with the continuously development of technology. This software was improved teaching together with student interaction. Simulation was using effective to describe abstract concept in Science Education which learners are in intensive interaction. The aim of this study was to investigate effect of simulation based teaching on the student achievement and attitude which subject of electrostatic induction. For this purpose, control (2 class, 57 person) and experiment (2 class, 59 person) groups were determined. During the 5 lesson period, experiment group were held with the simulation. After the study, it was found that simulations have improved students’ success on subject of induction and there is a significant difference between experimental and control groups. On the other hand, using simulation did not indicate a significant effect on students’ attitudes in this study.

Keywords: Simulations; electrostatic induction; science education.

1. Introduction

New materials have been developed permanently to ensure more efficient education in the educational environments. Technological developments have also directed for developing these materials. This period of time which arrive information and communication technologies, the process of developing materials have added richness with the using of computers in the educational environment. In the materials which are prepared at computer field, the visual and acoustic components has represent to the students as a whole and that provides to the students more interaction to the other materials. To raise the interaction between material and the student, have to need prepared developing and effective materials. The simulations which has been prepared with this way, compose more real environment, also they have provided to visualizing the events which impossible to see and ensured the students the learning by doing and living experience education situations. Simulation based teaching are to be effective as more interesting and motivating than many other methodologies, a better usage of computer technology and learning in the real world. Simulations divide into the two groups according to whether their main educational objective is to

E-mail address: ergulr@uludag.edu.tr

1877-0428 © 2009 Elsevier Ltd. Open access under CC BY-NC-ND license,
doi:10.1016/j.sbspro.2009.01.434
teach about something or to teach how to do something. The about something group subdivided into two subcategories, physical and iterative simulations. In physical simulations a physical object or phenomenon is represented on the screen, giving the user an opportunity to learn about it. In iterative the learner runs the simulation over and over, selecting values for various parameters at the beginning of each runs. In procedural simulations is to teach a sequence of actions to accomplish some goal. In situational simulations, learners are encouraged to explore alternatives and see their effects even when there are preferred procedural paths (Alessi, 2001). Simulations are effected method for motivate students as well as it’s reduce problem which using real material in education. Chang, Lin & Sung (2008) list in order to use simulations at education fields; providing background-knowledge, helping learners to make hypotheses, conduct experiments, interpret data and regulate the learning process. Abstract concepts have more effective learned in simulation based learning. Most of research showed that students were not understood the abstract concepts like heat, light, electricity, magnetism which encounter in Science Education (Eylon & Ganiel, 1990; Welzel, 1998). Electrostatic induction which included electricity subject is difficult concept to learn in Science Education. According to Akdeniz, Bekaş & Yiğit(2000) most of the students were not understand the related concepts of electricity. Students have comprised misconceptions easily in the learning electrostatic induction concept. Conceptual change texts (Baer & Geban, 2007), analogies (Heywood, 1997) and predict-observe-explain strategies which using mental process (Borges, 1999) were used for change this misconceptions. Furthermore, spatial ability was effected factor in the conceptual learning (Yang & Andre 2003). These findings indicated that the textbooks used for traditional methods and materials are not very effective to learn these concepts. Findings also showed that in order to overcome these deficiencies, the materials that were prepared in the study are required to support students’ spatial thinking skills. The purpose of this study is to investigate into the views of difference, student achievement and attitude between traditional teaching and simulation based teaching in Science Education. For this purpose, the following sub-problems were determined:

1. Are there any meaning differences about student achievement between experimental group and control group?

2. Are there any meaning differences about student attitude between pre-test and post-test for experimental and control group?

2. Method

The study employed pre-test and post-test with control group model. Analysis of covariance was used to compare between pre-test and post-test. One sample t test was used to analyze the data collected for the students’ attitude toward the science method course. The sample of the research was a total of 116 seventh class student during the 2008-2009 educational year, 59 students in experimental group, 57 students in control group. In the study, academic achievement test which include 36 questions was developed in order to evaluate students’ achievement. Results of the item analysis, KR-20 reliability coefficients were found as .92 and after that test is divided two parts as pre-test (18 items) and post-test (18 items). Each items in the tests were scored “1” point when responded truly. The scale used before and after the study for both experimental and control groups was implemented to determine students’ attitudes toward science course was developed by Çiçek(2006) and he found the reliability coefficient as .92. The study has carried out over duration of 5 periods. Before the commencement of the experiment, a Science Education attitude scale and the electrostatic induction preliminary achievement test were conducted on all students. During the study, simulation used for teaching at 3 periods with the experimental group, student studying with the simulation at 1 class period in the computer laboratory and summarized their learning on simulation at last 1 period. Control group studied with the traditional method. When the instructions have been completed, a final achievement test has been carried out and repeated the attitude test. SPSS package program has been utilized in the investigation to determine any significant differences between preliminary and the final tests. Simulations that used in study were developed by investigators. Simulations that related atomic structure, electrical charge, electrification were prepared according the aim of study. Physical simulations were developed using 3Ds Max, Macromedia Director Mx and Macromedia Flash Mx software. A web page prepared for the students access to simulations. Simulations prepared 3D animation form, therefore students studied with simulations like a real world. Total six simulations were present to students. Some screenshot examples were given in figure 1-2.
3. Findings

The first question was “are there any meaning differences about student achievement between experimental group and control group?” results are given in table 1 and table 2.

Table 1. Descriptive statistics according to post-test

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Revised Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group</td>
<td>59</td>
<td>.49</td>
<td>.48</td>
</tr>
<tr>
<td>Control Group</td>
<td>57</td>
<td>.35</td>
<td>.36</td>
</tr>
</tbody>
</table>
Pre-test means computed for experimental group (.32) and control group (.30). Table 1 indicates the revised mean which regarding the pre-test. Table 2 indicates the results of the analyses of covariance (ANCOVA) on the dependent variable which was the post-test scores and the covariate which were the pre-test score.

Table 2. Anova source table of the post-test scores by treatment

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>0.72702</td>
<td>1</td>
<td>0.727</td>
<td>25.08</td>
<td>.000*</td>
</tr>
<tr>
<td>Groups</td>
<td>0.45640</td>
<td>1</td>
<td>0.456</td>
<td>15.74</td>
<td>.000*</td>
</tr>
<tr>
<td>Error</td>
<td>3.27492</td>
<td>113</td>
<td>0.028</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4.54384</td>
<td>115</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This result showed that there was a statistically significant difference between post-test scores of students in the experimental group and control group. (F=15.74, p<0.001)

The second question was “are there any meaning differences about student attitude between pre-test and post-test for experimental and control group?” Attitude scale towards science method course was administered experimental and control groups in the beginning and end of the study. Table 3 indicates the results of one sample t test analyses of experimental groups’ students’ attitude toward science method course between pre-test and post-test.

Table 3. T-test analysis of experimental groups students’ attitude toward science method course

<table>
<thead>
<tr>
<th>N</th>
<th>X</th>
<th>Std. Deviation</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>59</td>
<td>3.946</td>
<td>0.79</td>
<td>115</td>
<td>-0.16</td>
</tr>
<tr>
<td>Post-test</td>
<td>59</td>
<td>3.948</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There are no significant differences between pre-test and post-test for experimental group (t=-0.16, p=0.98>0.05). Table 4 indicates the results of one sample t test analyses of control groups’ students’ attitude toward science method course between pre-test and post-test.

Table 4. T-test analysis of control groups students’ attitude toward science method course

<table>
<thead>
<tr>
<th>N</th>
<th>X</th>
<th>Std. Deviation</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>57</td>
<td>4.303</td>
<td>0.46</td>
<td>112</td>
<td>-1.18</td>
</tr>
<tr>
<td>Post-test</td>
<td>57</td>
<td>4.407</td>
<td>0.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There are no significant differences between pre-test and post-test for control group (t=-1.18, p=0.24>0.05).

4. Conclusion and Discussion

Succeed at in science is especially good at spatial thinking, it is not only way to solve a problem (Baker and Piburn, 1996). Abstract concepts were difficult to learn in science education. Student supported with pictures in the books and laboratory experiment for learning this concepts. Concepts have been transferred to student just single dimension using the pictures in the books. Also students can observe experiment results in the laboratory. Students can electrify the materials in experiment and observed charged material effect each other in learning electrostatic induction subject. But they can not imagined charge and moving charge in their mind. Simulations that prepared according to educational program help to the students for learning based on subject. So that students’ spatial abilities supported for explain this concept. In this study that were held with the 7th grade student, pre-test that using for
computing students’ achievement score in common for experimental and control groups. This score was indicating students’ information like each other before the study. According to the findings, it was found the average score for experimental group on students’ achievement is significantly higher than control group. It shows learning performance was better when using simulations in education than traditional education. Simulation based learning was increasingly effect student learning (Akgül et al., 2008; Aycan et al., 2002; Kumar and Sherwood, 2007). Simulations facilitated to students concept learning in Science Education (Stern, Barnea & Shauli, 2008). This findings is also supported from Chang et al. (2008). Finding nonsignificant difference on the students’ attitudes towards science methods course could be explained by limiting the studying methods with one course and the time that was spent for studying for this course.

5. References