An Investigation on Elementary School Students' Level of Math Learning, Using Math E-Books (A Case Study: Pishtazan Computer Primary School, 4th Zone of Tehran)

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Abstract
Since the focus on technology exists in all schools and classes, teachers need to know how to apply it in their teaching practices. The use of ICT in education is an undeniable necessity. Since the use of information and communication technology can smooth the paths of teaching-learning process for students, the researchers in this study tried to apply one of the information and communication technology tools, called "electronic books (E-books)" in teaching math. The aim of this study is to examine elementary school students' level of math learning, using math e-books with the focus on teaching multiplication (Case Study: Pishtazan computer primary school, the 4th zone of Tehran). Using a quasi-experimental study, 61 third grade students from two primary schools for girls located in the 4th education zone of Tehran were selected. Math tests were used to collect data. Using T-test for independent samples, the results showed that level of math learning was higher in the students who have been trained with the help of e-book, compared to the students who have been trained through traditional teaching method.

Keywords: Electronic book, e-book, Math, Technology, ICT, Multiplication, Primary school.

1 Introduction
In traditional teaching situations, the teacher explains the teaching subjects which have been set in a curriculum form, to the class. The class holds at a specified time and continues until a predetermined specified time. Teaching methods are face-to-face and almost constant. In traditional method, the teacher teaches the subject equally to all class, according to the predetermined program set by the textbook. The students sitting in rows listen to their teacher's explanations. It is also the teacher who assigns the home works and gives the next command. The ultimate goal of education is not clear for the students and learning does not take place based on the students' needs. The main reason for doing homework by the students is to gain teacher's satisfaction and to get a good mark. In this method, the program's content often contains materials which, according to the authors, will not be useful in the students' future life (Saffarian, et al., 2010
According to Saffarian et al. (1389), quoting from Polya (2001), the most important goal of teaching mathematics is thinking. They recommend teachers to improve their students' ability of think. Hence, today, the duty and responsibility of teachers has become heavier and more complicated than before. It is no longer possible to lead the society and people to a complicated and advanced evolution through the use of traditional methods (Shabani, 2003 [3]). Today, the need for modern teaching methods is felt, due to the ongoing increase in the development of science and technology. Therefore, the search for teaching methods which can direct students from rote learning to the actual learning must take place. Active teaching methods are among those methods which specially help the students and teachers, if be used. Active teaching methods are methods which stimulate the students' mental activity in the field of their general needs. In these methods, in addition to providing a variety of conditions, the learning must be taken place in students through encouraging and stimulating them, and all the educational messages must be transferred to them according to the children's center of interest and motivation, due to the fact that basically no change takes place in the learner's behavior, unless that change be originated from his internal willingness and natural desire (Saffarian, et al., 2010 [1]; quoted in Karimi, 2004 [4]). Using the technology of the day and considering e-learning, such as using computers, teachers can present their teaching materials in the form of multimedia applications that contain audio, video and graphics; and they can involve the students' visual and auditory senses in learning through the use of computer and multimedia software. Empirical findings in the field of psychology suggest that about 75 percent of human learning takes place through the use of visual sense, and 13% of it takes place through auditory sense. Therefore, using computer can be considered as one of the best methods for teaching and for students' learning. Information and communication technology reveals the hidden aspects of mathematical forms and directs students to the correct use of mathematical rules. Computer immediately displays the changes on the output and makes the understanding and exploring the mathematical models possible by putting together the multiple results obtained from information and communication technology, in a way that the inductive mentality created by the use of information and communication technology is significantly more reliable than its counterparts. Working with dynamic images or cartoons, portraying the ideas and mental images of students to investigate them with a better understanding of the subject, especially in mathematics is easily possible by the help of computers, due to the fact that using this method, mathematical calculations and similar activities can be simulated easily and computers by doing the needed calculations for each step, remove the unnecessary information and therefore, students understand the main purpose of the lesson (Zameni and Kardan, 2010 [5]). Since the use of information and communication technology can smooth paths of teaching-learning process for students, the researchers of present study attempt to use one of the tools of information and communication technology called "electronic book" to teach math. Considering the fact that in all societies, information technology is considered as a rich and valuable source in the way of informing people and learners, and that it has been for few years that in Iran, teaching math has been taught by the use of e-book along with the traditional teaching method, the researchers attempt to implement teaching mathematical subjects of primary school (in one of the educational grades) only through teaching via e-book. The researchers in this study tried to implement math teaching with the help of electronic pages in one of the smart schools or one of the schools that have access to information and communication technology, and investigate the results considering the students' level of math learning, compared to traditional method. Therefore, this study seeks to find an answer to this question that whether the level of students' learning is higher in students who are trained with the help of e-book, compared to the students who have trained by traditional method or not?

2 Literature Review

Some researches similar to the present study are briefly described below: Ahmadi and Nokhostin Rouhi (2014) [6], cited in the study by Shahamat et al. (2008) [7] showed that considering learning math and
compared to normal environment, students with verbal cognitive style had better performance in learning environment with the help of computers. Ahmadi and Nokhostin Rouhi (2014) [6], cited in Saffarian et al. (2010) [1] in an study, came to this conclusion that teaching mathematics by the use of educational software has more effects on students' academic achievement compared to traditional methods. Saffarian et al. (2010) [1] compared the effects of using educational software and traditional teaching method on fourth grade students' math learning in primary schools for boys in Qaemshahr city. In this study, 60 students were selected as the sample. The comparison of the average post-test scores between the two groups showed that statistically there was a significant difference between the performance of the two groups of experimental and control. The results showed that in math achievement test, the performance of students who have been trained via educational software was significantly better than those who have been trained in the traditional way. Krebs et al. (2010) in a study on mathematical learning through the use of ICT showed that it is a joint content creation tool, especially in writing and refining the content. There are several ways to use wiki pages in learning the contents. This tool helped the students in learning math to find mathematical reasoning to solve mathematical problems. These tools provide a collaborative learning for learning the contents. Hainey et al. (2011) evaluated the needed Games for its training and analysis in software engineering, in the higher education level. The results of their study showed the superiority of the new method over the traditional method. De Wever & Van Keer (2012) in a study on the students' attitudes towards their home works on computer pages and their related feedbacks, showed that students prefer to work with computer pages and in addition, providing feedbacks related to students' learning through computer pages, is one of the suitable ways of coordinating the feedback processes.

3 Research Methodology

In the studies in which the researcher is unable to fully control or manipulate the effective (independent) variable or variables, he tries to make his method in conducting the study closer to experimental method through identifying the variables and expanding the essential knowledge. In other words, although in many natural- social situations the variables in the study cannot be fully controlled, the researcher can use a research method similar to experimental study, to study and investigate the mentioned situation. Hence, in this study, the researchers used a quasi-experimental method of study.

3.1. Participants
The population studied in this research was all of the female students in two primary schools located in the fourth zone of Tehran, studying during the academic year 2014-2015. The selection of this statistical population took place based on the circumstances, the researchers’ available facilities and limitations of the study. The first school used electronic packages and materials in teaching for all courses (Iran's pishtazan computer school), but the second school used traditional teaching methods. Using cluster sampling method, after the selection of these two primary schools in the fourth education zone of Tehran, in the next step, the third grade was selected from among the whole grades in the two schools, and all the students in this grade were considered as our random sample. Therefore, considering the number of the students, 31 students were selected for the experimental group (the first school), and 30 students were selected for the control group (the second school).

3.2. Research Materials
In this study, math test was used as the tool or material. In accordance with the subject matter, that is using the help of electronic books in "teaching multiplication subject in the third grade", the researcher developed a pre- and a post-test including 8 questions with the total score of 20. These tests were designed and written in accordance with the standards of education organization and the new textbooks. For designing and developing the math pre-test's questions, the researchers used the consults with several teachers about the
prerequisite subjects for learning multiplication such as the concept of "categorization". Also, for the post-test, questions regarding "the content of multiplication", "multiplication operator" and issues related to that were designed and developed.

4 Data collection methods

At the beginning, after selecting the statistical sample, the researchers selected two schools for girls from the fourth education zone of Tehran: a school which used the packages and books with electronic contents, and another school which did not use e-books. The third grade primary school students from these two schools were randomly divided and assigned into two groups of control and experimental. In the control group, teaching was done in a traditional way and in the experimental group teaching was done in electronic forms. Pishtazan School used the Learning Management System (LMS). Learning Management System is a software that records and tracks the activities of the learner. The system automatically manages the teaching and learning process. A powerful learning management system facilitates the executive management training program within an organization. This system also enables learners to cooperate and collaborate with their peer learners. This is an e-learning and spatial learning program in which teaching programs are presented. The learners' use of this application for studying and learning at that time when they are on the network, is more like the act of students' entrance into the classroom through the door. Using LMS, the students choose their courses and receive the educational materials, complete their coursework or exercises, participate in exams and communicate with their teacher and the other students. This system registers the list of the users and learners, categorizes the educational fields, records the learners' information, and also prepares special and specific reports for the administrator. Hence, in these schools, the students view their books in scanned form and as electronic contents and all the exercises and teachings are presented to them via computer and tablet. A report on students' performance will be constantly recorded on the website and these reports are visible to the parents. According to the topic of the study, the researchers investigated the methods of teaching "the concept of multiplication" in this school. At first, a pretest was taken from the students of both groups, about the prerequisite concepts in relation to the "multiplication subject" in the third grade. In the experimental group, at the first school, the teachers taught mathematics with the help of electronic packages and contents. After teaching each subject matter, for the case of practicing and a better and more attractive learning for the students, the teacher used electronic methods which were approved by the Curriculum Development Council. Most of the teachers used the software and electronic contents, for "teaching multiplication" such as the following materials: This mathematical electronic content that is in the form of Flash files is suitable for teaching third grade primary school students. By dragging down the empty squares to the right or left, you can display different multiplications. This content, despite being simple, helps the teachers of third grade elementary school in transferring the concept of multiplication (see Figure 1 and 2). As can be seen in the figures, the teacher or the student can move the cutting line from top to down or from left to right, with any number of categories and up to numbers more than two digits, to calculate multiplication and its concept without counting all the circles. Multiplications are displayed in the right corner of each window, and the student can guess the number of all the circles by multiplying the row and the column:
5 Results

To review this section, we first calculate the descriptive criteria such as mean, standard deviation and mode for pre-test and post-test scores in traditional methods, formative evaluation, and collaborative learning, the results of which are presented in Table 1:
Table 1: Descriptive statistics of the pre-test results

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Control group</th>
<th>Experimental group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>Mean</td>
<td>14.76</td>
<td>14.54</td>
</tr>
<tr>
<td>Mode</td>
<td>13.5</td>
<td>14.25</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2.06</td>
<td>1.87</td>
</tr>
</tbody>
</table>

According to Table 1, it is clear that in the pre-test results obtained from control group and experimental group, the average score in the control group has no significant difference from the average score in the experimental group. In other words, it is shown that all of the students have a same level in pre-test. Moreover, the most frequent score with the highest value belongs to the experimental group. The lowest dispersion index among the grades belongs to the experimental group.

Table 2: Descriptive statistics of the post-test results

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Control group</th>
<th>Experimental group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>Mean</td>
<td>14.74</td>
<td>17.13</td>
</tr>
<tr>
<td>Mode</td>
<td>12.75</td>
<td>18.5</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2.05</td>
<td>1.44</td>
</tr>
</tbody>
</table>

According to Table 2, it is clear that in the post-test results obtained from the two groups of control and experimental; the average score in the experimental group has a significant difference from the average score in the control group. Moreover, the most frequent score with the highest value belongs to the experimental group. The lowest dispersion index among the grades belongs to the experimental group, which shows that there is not a large dispersion among the grades. Since the P-values obtained in Table 3 are all greater than 0.05, the hypothesis considering the normality of the scores is supported. In order to compare the performance of the students in pretests of the traditional method and the use of e-books, the following hypothesis test is considered: According to the support for the normality of the data, to test the above-mentioned hypothesis, T-test is used for independent samples, the results of which are showed in Table 3 below:

Table 3: T-test results for independent samples in pre-tests

<table>
<thead>
<tr>
<th>Pre-test</th>
<th>Levene test for equality of variances</th>
<th>T - test for equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>P-value</td>
</tr>
<tr>
<td>variances were assumed equal</td>
<td>0.45</td>
<td>0.5</td>
</tr>
<tr>
<td>variances were not assumed equal</td>
<td>0.43</td>
<td>58.06</td>
</tr>
</tbody>
</table>

The results in a Table 3, show that the P-value obtained for the variances is higher than 0.05 (0.5 >0.05); therefore, assuming equality of variances, we deal with reviewing the pre-tests. As it is shown, the obtained P-value is higher than 0.05 (0.66> 0.05), so there is no significant difference between the pre-test data means
in the two groups of control and experimental. Hence, it can be concluded that the learning level of the students, trained by traditional method and students, trained by the use of e-book are the same at the beginning. At the end, a comparative test as the post-test was used for the above-mentioned two groups. According to the support for the normality of the data, to test the above-mentioned hypothesis, t-test for independent samples were used, the results of which are shown in Table 4 below:

<table>
<thead>
<tr>
<th>Pre-test</th>
<th>Levene test for equality of variances</th>
<th>T - test for equality of means</th>
<th>%95 confidence interval difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>P-value</td>
<td>t</td>
</tr>
<tr>
<td>variances were assumed equal</td>
<td>4.37</td>
<td>0.04</td>
<td>-5.28</td>
</tr>
<tr>
<td>variances were not assumed equal</td>
<td>-5.28</td>
<td>0.000</td>
<td>51.82</td>
</tr>
</tbody>
</table>

The results in Table 4 show that the P-value obtained for the variances is smaller than 0.05 (0.04 <0.05); therefore, assuming inequality of variances, we deal with reviewing the post-tests. As it is shown, the obtained P-value is smaller than 0.05 (0.000< 0.05), so there is a significant difference between the post-test data means in the two groups of control and experimental. Hence, it can be concluded that the learning level of the students, trained by traditional method and students, trained by the use of e-book are not same. In other words, since the post-test mean in the experimental group is higher than the post-test mean in control group (17.13> 14.74), it can be argued that the learning level of students who have been trained through the help of E-book is higher than the Students have been trained through the traditional method.

6 Conclusion

By answering the research question it was proved that the learning level of the students, who had been trained by the help of e-book, is higher than the learning level of the students who had been trained by traditional method. E-book can have a decisive role in students' learning. Because it cannot be expected that students in the classes without the use of new educational tools, achieve the high levels of learning through traditional teaching methods with the dry environment it makes. In such classes, students will remain unmotivated to studying, since their learning needs cannot be met and a boring environment will be created for the teachers and the students. Accordingly, It can be understood that by the progress of science and teaching principles, the use of e-books has shown better effects on education compared to the traditional systems and has achieved a greater success rate. The e-book is valuable due to the supply of knowledge in several ways. Students can learn abstract principles by writing and watch the application of the same principles through animation or video. This variety provides a deeper opportunity. Therefore, we must think about some plans and use them to enhance the level of learning at schools to its highest peak. The results of this research on the benefits of electronic math books were as follows:

1. An electronic math book creates real reasons to read and write and modify the communication.
2. An electronic math book helps the teachers to pay attention to the class students and the lessons in new form.
3. An electronic math book, changes the role of the teacher from a lecturer and the environment of the class from teacher centered to a facilitator of learning and learner-centered environment respectively.
4. An electronic math book allows the teachers to identify different learning styles in the class.
Therefore, as it seemed before, a closer monitoring on the performance, learning, and assessment of the student during the learning process, led to the higher level of learning among the students who were trained by the help of e-book, compared to the students who were trained through the traditional method. The results of this study are partly consistent with the results of Golzari (2004), Zameni and Kardan(2010) [5], Ahmadi and Nokhostin Rouhi (2014) [6], Saffarian et al. (2010) [1], Christian and Gerber (1990 ), Harrison et al. (2002), Krebs et al. (2010), and Hainey et al. (2011). The researcher offers the following practical suggestions:

1) Based on what appeared on the surface, it was assumed that the students' mentality about e-books is positive, but this was rejected, since it seems that gender and age variables affected this study. Bellow, working on this hypothesis will be recommended.

2) It is suggested that the use of electronic textbooks be implemented in educational centers, in the areas with ethnic and cultural varieties, so that this type of teaching method can be compared with traditional teaching methods in these areas.

3) It is suggested that technical- software training courses in the field of e-learning be implemented for the teachers and trainers, and its results be evaluated.

4) It is suggested that technical- hardware training courses in the field of e-learning be implemented for the teachers and trainers, and its results be evaluated, and

5) It is suggested that the electronic test evaluation design be presented to software professionals for the issue of producing educational contents and be implemented.

References


