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The effects of educational computer games on students' attitudes towards mathematics course and educational computer games

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Abstract

The purpose of this research is to determine the differences of attitudes of students, who played the educational computer games developed for this research, towards both mathematics course and educational computer games. For this reason, researchers developed two educational computer games, Proportional Tetris and Proportional Clown, which are about ratio and proportion topic in mathematics education. Researchers used a survey including a demographic data form and two likert-like scales about both mathematics course and educational computer games. Educational computer games and the survey were applied to 176 students in two primary schools in Balikesir, Turkey. Whether educational computer games affected the students' attitudes towards both mathematics course and educational computer games was tested with Paired Samples t test. Whether there is a meaningful relationship between students' attitudes towards mathematics course and students' attitudes towards educational computer games was tested with Pearson Correlation test. As a result, students' attitudes towards both mathematics course and educational computer games became positive. But there wasn't any change in attitudes of students who played Proportional Tetris and Proportional Clown.
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Keywords: Educational computer games; digital game based learning; ratio and proportion; mathematics teaching.

1. Introduction

Recent rapid development of computers and technology forces educational institutions to use it in solving educational and instructional problems. Although education and technology are different terms, using them together introduce a new concept, educational technology. Educational technology makes teaching and learning activities enjoyable. Thanks to educational technology, students learn with playing, having fun and loving (Isman, 2005).

Computer aided instruction is the method that students can see their performance, control their learning with getting feedbacks, engage the lesson with graphics, sounds, animations and figures (Baki, 2002).

Effectiveness of computer aided instruction is substantially related with the quality of the courseware. While good quality software affects the student's success positively, bad quality software can cause waste of time and getting undesired behaviors for students (Demirel et al., 2003).

One of the applications of computer aided education is educational computer games. There are many researches about effects of games on children's cognitive development and conceptual approaches to games. The most important studies in this subject were performed by Piaget and Vygotsky. These studies became the reference point for the later studies in this subject.

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Vygotsky thought that game contributes to the cognitive development importantly instead of reflecting the cognitive development simply (Nicolopoulou, 2004).

Educational computer games, which include motivational and funny features of computer games, can be used as an alternative or supportive to the other instructional methods in the direction of instructional or educational goals.

According to Prensky (2001a) there are six structural factors which make a game a game:

1.   Rules: Rules impose limits and they force us to take specific paths to reach goals and ensure that all the players take the same paths.
2.   Goals or Objectives: Goals or objectives create duty sense on us. So we play the game voluntarily and spend time and make an effort for it.
3.   Outcomes and Feedback: Outcomes and feedback are how you measure your progress against the goals. Feedback comes when something in the game changes in response to what you do.
4.   Conflict, Competition, Challenge and Opposition: Conflict, competition, challenge and opposition are the problems in a game you are trying to solve.
5.   Interaction: Interaction has two important aspects. The first is the interaction of the player and the computer. The second is inherently social aspect of games that you do with other people.
6.   Representation: Representation means that the game is about something.

According to Prensky (2002), students' motives for learning are a mixture of intrinsic goals and extrinsic rewards, combined with psychological factors such as fear and need to please. If strong enough, these motives can and do pull students through to the end. According to Rieber (1996; cited by Can, 2003), educational computer games are the best way for students to be responsible for their learning.

Students grow up in a quite different environment than their parents in today's world. They have used technological tools in all of their life. And this situation has affected their points of view, lifestyles, and expectations enormously. According to the research performed by Tapscott (1997), students are very different from their parents in the point of learning, playing, communicating, working and creating societies.

1.1. Importance

In mathematics education, generally the methods of narration and question-answer are used. But these methods bring along that students expect ready information and they don't enforce themselves to retrieve information and don't query the correctness of the information. Besides these method can be boring for students. For an effective instruction, students are required to be motivated and actively participate in the lesson.

In mathematics education, there is a need for the information learned and used when required instead of the information learned and forgotten. Computer is an appropriate tool for students to reach the information directly by learning by doing. Educational computer games, a branch of computer aided instruction, are important alternatives to prepare the environment mentioned here. Thanks to the educational computer games, students can learn by doing, experiencing, and enjoying without getting bored. Students can learn easily by concreting abstract concepts in the electronic environment.

Even though all these positive approaches convince the mathematics teachers to use education computer games in their lessons, there is not enough number of research performed in this topic and developed educational computer games in Turkey. This situation necessitates new researches to be done in this topic.

1.2. Purpose

The purpose of this research is to determine the differences of attitudes of students, who played the educational computer games which were developed for this research, towards both mathematics course and educational computer games.

1.3. Research Questions

The main problem of this research is that whether educational computer games developed for this research have an influence on the attitudes of students towards both mathematics course and educational computer games.

The sub questions of the main problem are in the following:

1.   Is there any significant difference in attitudes of students towards mathematics course between before and after they played the educational computer games?
2.   Is there any significant difference in attitudes of students towards educational computer games between before and after they played the educational computer games?
3.   Is there any significant relationship between the attitudes of students towards mathematics course and the attitudes of students towards educational computer games?

2. Method

Data was collected from 176 7th grade students in two primary schools in Balikesir, Turkey. Cluster sampling method was used to select students. The frequency distribution of the students is given in Table 1.

Table 1. Students' Schools and Genders

Schools	Male		Female		Total	
	f	*%*	*f*	*%*	*F*	*%*
Atatürk Primary School	44	25,0	50	28,4	94	53,4
Fatih Primary School	41	23,3	41	23,3	82	46,6

Students' demographic data form and two likert-like scales about the attitudes of students towards both mathematics course and educational computer games were combined in a form and applied to the students.

In the students' demographic data part of the survey, there are personal questions like their school, age, parents' educational background and job, whether there is a computer at home, where to use computer, how often they use computer, what computer means for them, whether they want to start a job related with computer in the future, lessons they like, whether parents let them to play computer games, how often they play computer games, how many years they have played computer games.

The likert-like scale about the attitudes of students towards mathematics course was obtained from the Internet address of Ministry of National Education's site (http://ogm.meb.gov.tr/mat_9.doc). Reliability of the scale was tested with Cronbach Alpha coefficient and calculated as 0.795. According to this value, the scale was appeared to be quite reliable.

In the likert-like scale about the attitudes of students towards educational computer games, there are 24 items. 13 of them were obtained from the survey developed by Can (2003). Other 11 items were developed by the researchers. Pilot study was performed with 7th grade students in Zagnospasa Primary school in Balikesir. According to the results of pilot study and the experts' views, the scale was given final shape. Reliability of the scale was tested with Cronbach Alpha coefficient and calculated as 0.661. According to this value, the scale was appeared to be reliable enough.

Firstly students were applied the survey. And then they played the educational computer games, Proportional Tetris and Proportional Clown. Whey they played the games sufficient time enough, they were applied only the scales part of the survey again.

3. Findings

The findings of this research were obtained from the survey applied to the students. Statistical results are given in the following

3.1. Students' Attitudes towards both Mathematics Course and Educational Computer Games

According to the results of the scale, it was appeared that the most of the students had positive attitudes towards mathematics lesson. 79% of them selected Strongly Agree or Agree choices in the item "I can learn mathematics". 73% of them selected Strongly Disagree or Disagree choices in the item "Mathematics is annoying for me" with negative meaning.

Most of the students had also positive attitudes towards educational computer games. 83.5% of them gave the positive answer to the item "I like playing computer games". 72.1% of them gave the positive answer to the item "I think that computer games can be used for educational purposes".

3.2. The Effect of Playing Educational Computer Games on the Students' Attitudes towards Mathematics Course

Whether there is any significant difference between the students' total attitudes scores towards mathematics course calculated before and after they played the educational computer games was tested with Paired Samples T test. Results of this test were given in Table 2.

Table 2. Paired Samples T Test for the Students' Attitudes towards Mathematics Course Before and After

	N	$\overline{X}$	SS	Differences between $\overline{X}$	SS	t	Df	P
Before	79	47,85	9,089	-1,278	8,252	-1,377	78	,172
After	79	49,13	7,682					

As seen in Table 2, it was appeared that there was not any significant difference between the students' total attitudes scores towards mathematics course calculated before and after they played the educational computer games ($t_{(78)}$ = -1,377, p>0,05).

3.3. The Effect of Playing Educational Computer Games on the Students' Attitudes towards Educational Computer Games

Whether there is any significant difference between the students' total attitudes scores towards educational computer games calculated before and after they played the educational computer games was tested with Paired Samples T test. Results of this test were given in Table 3.

Table 3. Paired Samples T Test for the Students' Attitudes towards Educational Computer Games Before and After

	N	$\overline{X}$	SS	Differences between $\overline{X}$	SS	t	df	P
Before	53	84,72	10,758	-1,453	10,074	-1,050	52	0,299
After	53	86,17	10,655					

As seen in Table 3, it was appeared that there was not any significant difference between the students' total attitudes scores towards educational computer games calculated before and after they played the educational computer games ($t_{(52)}$ = -1,050, p>0,05).

3.4. The Relationship between the Students' Attitudes towards Mathematics Course and the Students' Attitudes towards Educational Computer Games

The relationship between two variables, students' attitudes towards mathematics course and the students' attitudes towards educational computer games, was tested with Pearson correlation. Pearson correlation coefficient was calculated as 0.177. As a result, it was appeared that there was a low level positive significant relationship between these two variables. In other words, it can be said that students who have positive attitudes towards mathematics course have also positive attitudes towards educational computer games.

4. Conclusion

Most of the students have positive attitudes towards mathematics course. In addition it was appeared that most of them have also positive attitudes towards educational computer games. Findings in literature are parallel with this finding (Prensky, 2001a).

Attitudes of students towards mathematics course did not changed after they played the educational computer games. Attitudes generally change difficultly and it takes long time. Students have already positive attitudes towards mathematics course. So it can be said that this finding is normal and expectable.

Attitudes of students towards educational computer games did not changed after they played the educational computer games. Having already positive attitudes and time limitation to play educational computer games could cause this result to happen. If more and various educational computer games were used and application time extended, students would have more positive attitudes towards educational computer games. According to the experimental researches in literature, it was concluded that educational computer games can be used for educational purposes effectively (Mitchell & Savill-Smith, 2004; Can, 2003; Tüzün et al.., 2006).

It is come to light that students who have positive attitudes towards mathematics course have also positive attitudes towards educational computer games. According to this finding, it can be said that students who are successful in mathematics course have also positive attitudes towards educational computer games.

As a result it can be said that educational computer games can be used as a supportive to the other instructional methods in the direction of instructional or educational goals.

There is not enough number of research performed and educational computer games developed in Turkey. So, more researches should be performed in this subject area.

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