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Original Article

The Effect of Educational Software on Students' Mathematical Problem-Solving Skill

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Abstract

This study aimed to examine the effect of educational software on 3rd-grade elementary-school students' mathematical problem-solving skill. This was a quasi-experimental, pretest-posttest, controlled study. The statistical population comprised all 3rd-grade elementary-school male students in District 4 of Karaj (Iran) in the academic year 2018-2019. A sample was selected via convenience sampling, and the participants were randomly assigned to two experimental and control groups (20 each). On pretest, two tests of "numerical analysis" and "attention and concentration" (Wechsler test) and a researcher-made problem-solving skill test were administered. Then, the experimental group received eight 40-minute sessions of software training, while the control group received the class's routine education. Finally, both groups took the posttest. The data were analyzed via univariate analysis of covariance and independent samples t-test. After the experimental intervention, the two groups demonstrated a significant difference ($p < 0.001$) at three levels of "problem-solving speed", "attention and concentration", and "numerical analysis". The two groups also showed a significant difference at the level of "problem-solving strategy identification" ($p < 0.05$). Accordingly, the role of educational media, and especially educational software, can be highlighted in promoting students' learning and mathematical problem-solving skill.

Keywords

Mathematics; problem-solving skill; educational software.

Introduction

Dyscalculia is a well-recognized disorder causing serious problems in students 'education (Miciak, J., & Fletcher, J M, 2020). People with learning disorders show diverse and complex characteristics and needs. Accordingly, great challenges are posed to the family and specialists (Jitendra, A. K., Lein, A. E., & Mouanoutoua, J., 2018). Six percent of children of school age have major problems with mathematics (Beckman, A., & Minnart, A., 2018). The common problems of dyscalculia include difficulty with different components of mathematics, including learning the name of numbers, recalling plus and minus sights, memorizing the multiplication table, translating written problems into calculation, and performing calculation at the expected level. The majority of these symptoms can be detected in grades 2 or 3 of elementary school (Mutlu, Y., 2019). Leaning calculation skills helps children apply what they have learned to problems they face, and utilize the capabilities acquired to solve everyday problems (Qalamzan, Moradi, Abedi, 2014). Therefore, problem-solving skill has long been an inseparable component of mathematical skills. In each problem, there are two groups of known and unknown factors; relying on mathematical calculation processes, known as solution, learners move from known data to the unknown factors (Johnson, E. S., Clohessy, A. B., & Chakravarthy, P, 2018). In many cases, children with dyscalculia find it difficult to understand the conceptual language of mathematics, cannot

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determine the knowns and unknowns of the problem, or cannot understand the relationships among the data and what is asked of them (). children with dyscalculia have difficulty in mathematical executive processes and use crude problem-solving strategies such as finger counting and verbal counting (Emami, Sohrabi, 2018). The development of students' problem-solving skills is a major goal in mathematics education. Problem-solving is an important goal in mathematics education because it is indispensable in people's lives (Bonyadi, Dehqani, 2020). Problems, and especially mathematical problem-solving, have received attention from education and mathematics education experts in recent years. Research shows that mathematic problem-solving skill is affected not only by knowledge structures and information processing, but also by motivational factors, including beliefs, attitudes, values, and anxiety (Hamidi, Dazi, Lotfi, 2020). Development of students' problem-solving skills is one of the goals of mathematics education. Problem-solving is an important goal in mathematics education because it is indispensable in people's lives (Kaur, D., Koval, A., & Chaney, H. , 2017).

Two domains should receive special attention when attempting to improve the problem-solving ability: improving students' problem-solving skill through science education and detecting their problems in this domain, and finding ways to help them overcome these problems (Kanbay, Y., & Okanlı, A. , 2017). The rise in the use of information and communication technology promises a major evolution in all domains, including teaching and learning. With the emergence of computers, multimedia, in the form of educational software, became greatly popular; thus, their effects in educational systems, especially in the teaching/learning process, received great attention (Akben, N , 2020).

Today, computers play different roles in schools; they help with education, facilitate teaching, provide opportunities for students to use technology, and are useful tools for doing homework (Saygılı, S. , 2017). Studies by Dwyer (2019) showed that teachers' professional capability is increased by the use of information and communication technology, and this is possible only if they be a laboratory group for using theses technologies. (Dindar, 2018). Two domains should receive special attention when attempting to improve the problem-solving ability: improving students' problem-solving skill through science education and detecting their problems in this domain, and finding ways to help them overcome these problems (Wassie, Y. A., & Zergaw, G. A, 2019). So far, few studies have investigated the efficiency of educational software for students' mathematical problem-solving skill. Accordingly, the present study aimed to determine the effectiveness of educational software on students' mathematics problem-solving skill. Based on what was said, the question that is raised is, what is the difference between students who use math educational software and students who do not use math educational software, in terms of speed of problem solving, attention and concentration, and numerical analysis?.

Method

This was an applied quasi-experimental pretest-posttest controlled study. The statistical population comprised all 3rd-grade elementary-school students in District 4 of Karaj (Iran) in the academic year 2018-2019, of whom 40 studying in Dr. Hossein Mahmoud school (Pishahangi region, Karaj) were selected and randomly allocated to experimental and control groups (20 each). The inclusion criteria were: Having poor mathematical problem-solving skills, absence of learning disorders and ADHD, no history of neurological or psychological disorders, the ability to take part in educational sessions, and willingness to participate. The exclusion criteria for the experimental group were: Absence from the interventional sessions for more than 2 sessions, and unwillingness to continue taking part in the sessions.

Research instrument

1) A demographic information questionnaire

This questionnaire aimed to collect demographic data as the baseline information, including age, socioeconomic status, the number of siblings, and a history of learning disorders.

2) A researcher-made mathematics problem-solving skill

Two researcher-made questionnaires, each with 9 questions (shape drawing, pattern finding (pattern making tables), sub-problem solving (problems within problems), simple problem solving, guess and check, and symbolic strategies discussed in the 3rd-grade mathematics textbook) were used to assess the understanding of mathematic and numerical analysis in problem-solving strategies. To prepare these questionnaires, similar research tools were used. The time the participants took to take the tests was also recorded to assess the problem-solving speed. The time allowed for each test was 60 minutes. The total score of the questions for each strategy indicates the person's score for that strategy. The scores were interpreted as follows: > 18: very good; 16-18: good; 12-16: acceptable; <12: needs improvement. This questionnaire had a Cronbach's alpha of 0.821, indicating the instrument's good reliability.

3) Wechsler's numerical analysis, attention, and concentration questionnaire

This questionnaire was developed based on Wechsler's standard tests (1939), its revised version (1980), TIMSS, and the primary Wechsler scale for adults, including verbal and performance subtests, as well as different programs and an overall intelligence quotient (IQ). In 1949, however, Wechsler developed the intelligence and attention scale for children to assess the intelligence of children aged five years and above with the same method as that for adults, with some modifications. The last revised form of the Wechsler test was published in 1981. This tool is used to assess attention (Rabiee & Abedi, 2011). In this questionnaire, there are 10 questions on attention and concentration, and 20 questions on numerical analysis. In this study, the score of attention and concentration was assessed based on academic achievement in 3rd-grade mathematics. The sum of scores of calculation and information was assessed against elementary-school academic achievement. High scores indicate alertness, concentration ability, lack of distraction, and a good memory, while low scores indicate lack of concentration, poor mathematical reasoning, distraction, and poor academic background (Rabiee & Abedi, 2011). Cronbach's alpha was used to determine the tests' reliability, i.e., the internal consistency of the components. A Cronbach's alpha of 0.818 was obtained for the numerical analysis, attention, and concentration questionnaire, indicating the good reliability of the instrument.

Procedure and Data Analysis

After receiving the required approvals, Dr. Hossein Mahmoud elementary school in Pishahangi region (Karaj) was selected. Of the 3rd-grade classes, 40 students were randomly selected and assigned to two groups of 20, based on the inclusion criteria. Explanations were given to them about the nature and procedure of the study. After the participants provided consent for participation, they were randomly assigned to the two groups. All the participants completed the demographic information and the Wechsler's numerical analysis, attention, and concentration questionnaires. The interventions were provided based on educational software. The participants completed the questionnaires twice, once before (pretest) and once after the intervention (posttest). The educational software was that accompanying the 3rd-grade mathematics textbook developed by the Materials Development Office in 2017-2018. First, the pretests were administered to examine the students' mathematical problem-solving level and record their scores. Then, based on their scores, the participants were randomly assigned to two groups of 20 (experimental and control groups). The researcher provided problem-solving skills training via educational software to the experimental group for two months (eight 40-minute sessions). The control group received routine education. Afterwards, the posttest (problem-solving test and Wechsler's test) was administered to both groups. The data obtained from the research questionnaires were analyzed by spss.v24 software. Among the ethical considerations that were considered in the research was that the respondents participated in the research with full knowledge and they were assured that their opinions and answers will not be presented anywhere else.

Results

The participants were 40 third-grade students (20 in the control and 20 in the experimental group) with the mean age of 9 years. The data were described using mean, SD, kurtosis, and skewness. The research questions were answered by the analysis of covariance, Kolmogorov-Smirnov test, and independent samples t-test.

Table 1. Central tendency and dispersion indices of problem-solving speed, problem-solving attention and concentration, numerical analysis, and problem-solving strategy understanding

Components	**Sub Component**		**Group**	**Number**	**Mean**	**SD**
Problem-solving speed	Pretest		Experimental group	20	54.53	5.85
			Control Group	20	52.13	5.24
	Post-test		Experimental group	20	42.33	6.77
			Control Group	20	53.26	6.09
Problem-solving attention and concentration	Pretest		Experimental group	20	16.13	1.35
			Control Group	20	15.53	1.84
	Post-test		Experimental group	20	18.80	0.86
			Control Group	20	16.06	1.90
numerical analysis	Pretest		Experimental group	20	17.46	2.06
			Control Group	20	16.06	2.15
	Post-test		Experimental group	20	18.93	0.88
			Control Group	20	16.20	1.56
Understanding problem-solving strategy	Pattern finding	Pretest	Experimental group	20	3.73	0.35
			Control Group	20	3.46	0.81
		Post-test	Experimental group	20	4.86	0.44
			Control Group	20	3.66	0.47
	Simple problem-solving strategy	Pretest	Experimental group	20	1.66	0.17
			Control Group	20	1.60	0.48
		Post-test	Experimental group	20	1.93	0.48
			Control Group	20	1.46	0.50
	Shape drawing	Pretest	Experimental group	20	1.66	0.48
			Control	20	1.60	0.50

strategy		Group			
	Posttest	Experimental group	20	1.93	0.17
		Control Group	20	1.33	0.48
Guess and check strategy	Pretest	Experimental group	20	3.06	0.88
		Control Group	20	3.66	1.29
	Posttest	Experimental group	20	3.66	0.48
		Control Group	20	2.60	1.12
Symbolic strategy	Pretest	Experimental group	20	1.53	0.54
		Control Group	20	1.60	0.50
	Posttest	Experimental group	20	2	0
		Control Group	20	1.66	0.48
Sub-problem strategy	Pretest	Experimental group	20	1.60	1.39
		Control Group	20	1.66	1.16
	Posttest	Experimental group	20	1.86	0.35
		Control Group	20	1.66	0.50
Knowledge of problem solving	Pretest	Experimental group	20	1.40	0.50
		Control Group	20	1.53	0.51
	Posttest	Experimental group	20	1.86	0.35
		Control Group	20	1.46	0.51

Table 1 presents the central tendency and dispersion indices of the research components. The mean pre- and posttest scores of the two groups were 15.53-54.53. The mean pretest score of the experimental group on problem-solving speed was 54.53 (maximum score), while the mean pre-test score of the control group on problem-solving attention and concentration was 15.53 (minimum score). Moreover, the SD of pre- and posttest scores was 0.86 (posttest of the experimental group on problem-solving attention and concentration) to 6.77 (posttest of the experimental group on problem-solving speed). Furthermore, the mean pre- and posttest scores of the two groups were 1.33-18.13. The mean posttest score of the experimental group on problem-solving skill was 18.13 (maximum score), while the mean posttest score of the control group on shape drawing strategy was 1.33 (minimum score). Moreover, the SD of pre- and posttest scores was 0 (posttest of the experimental group on symbolic strategy) to 2.09 (pretest of the control group on problem-solving skill).

After describing the variables and responses obtained from the statistical population, in this section, the research hypotheses and the statistical tests are discussed. In other words, in this section, the findings are analyzed so that the accuracy of the hypotheses can be statistically assessed.

Table 2. Kolmogorov-Smirnov Test

Components	Sub Component		Group	Significance level	Error	Hypothesis confirmation	Conclusion
Problem-solving speed	**Pretest**		Experimental group	0.24	0.05	H0	Normal
			Control Group	0.23	0.05	H0	Normal
	Posttest		Experimental group	0.58	0.05	H0	Normal
			Control Group	0.56	0.05	H0	Normal
Problem-solving attention and concentration	**Pretest**		Experimental group	2.18	0.05	H0	Normal
			Control Group	1.58	0.05	H0	Normal
	Posttest		Experimental group	0.62	0.05	H0	Normal
			Control Group	0.85	0.05	H0	Normal
Numerical analysis	**Pretest**		Experimental group	0.54	0.05	H0	Normal
			Control Group	0.55	0.05	H0	Normal
	Posttest		Experimental group	0.49	0.05	H0	Normal
			Control Group	0.11	0.05	H0	Normal
Understanding problem-solving strategy	**Pattern finding**	Pretest	Experimental group	0.48	0.05	H0	Normal
			Control Group	0.11	0.05	H0	Normal
		Posttest	Experimental group	0.52	0.05	H0	Normal
			Control Group	0.45	0.05	H0	Normal
	Simple problem-solving strategy	Pretest	Experimental group	0.29	0.05	H0	Normal
			Control Group	0.33	0.05	H0	Normal
		Posttest	Experimental group	0.41	0.05	H0	Normal
			Control Group	0.18	0.05	H0	Normal
	Shape drawing strategy	Pretest	Experimental group	0.21	0.05	H0	Normal
			Control Group	0.28	0.05	H0	Normal
		osttest	Experimental group	0.42	0.05	H0	Normal
			Control Group	0.14	0.05	H0	Normal

		Pretest	Experimental group	0.22	0.05	H0	Normal
			Control Group	0.26	0.05	H0	Normal
	Guess and check strategy	Posttest	Experimental group	0.22	0.05	H0	Normal
			Control Group	0.11	0.05	H0	Normal
		Pretest	Experimental group	0.09	0.05	H0	Normal
			Control Group	0.10	0.05	H0	Normal
	Symbolic strategy	Posttest	Experimental group	0.12	0.05	H0	Normal
			Control Group	0.21	0.05	H0	Normal
		Pretest	Experimental group	1.64	0.05	H0	Normal
			Control Group	1.02	0.05	H0	Normal
Understanding problem-solving strategy	**Sub-problem strategy**	Posttest	Experimental group	0.11	0.05	H0	Normal
			Control Group	1.09	0.05	H0	Normal
		Pretest	Experimental group	0.18	0.05	H0	Normal
			Control Group	0.91	0.05	H0	Normal
	Pattern making strategy	Posttest	Experimental group	0.12	0.05	H0	Normal
			Control Group	0.23	0.05	H0	Normal

Based on Table 2, As the significance level is more than the error (0.05) for all the components, these variables have a normal distribution. Moreover, since the statistical power is 0.95, which is > 0.80, the sample size is acceptable for this research.

The main research hypothesis: There is a difference between students who use mathematics educational software and those who do not in terms of problem-solving skill.

An analysis of covariance was performed to test this hypothesis, and the assumptions (normality test, homogeneity of variances, and slope of the regression line) were examined in order. The normality of the data was confirmed. The significance level for all the components was more than the error (0.05); therefore, the groups' variance was homogeneous. The groups x problem-solving skill pretest interaction was not significant; in other words, the data supported the assumption of regression slopes' homogeneity (f = 2.17, p = 0.15).

Table 3. Results of ANCOVA

Source	Sum of Squares	Df	Mean of Squares	F value	Significance level
Pretest Problem-solving skill	5.69	1	5.69	3.78	0.003
Group	159.13	1	159.13	105.73	0.0001
Error	40.63	27	1.50		
Total	7753.00	30			

Based on Table 3, after adjusting the problem-solving skill pretest scores, the two groups showed a significant difference at the error level of α=0/05 (f = 105.73, p = 0.0001). Thus, the null-hypothesis (lack of difference between the two groups) is rejected; in other words, there is a significant difference between the two groups in terms of problem-solving skill, and this difference was due to the use of the educational software.

There is a difference between the students who use mathematics educational software and those who do not in terms of problem-solving speed. To test this hypothesis, a t-test was run as follows.

Table 4. T-test for the variable of problem-solving speed

Variable		Number	Mean	SD	Df	T	Significance level
Problem-solving speed (pretest)	Experimental group	15	54.53	5.85	28	0.91	0.36
	Control Group	15	52.13	5.24			
Problem-solving speed (posttest)	Experimental group	15	42.33	6.77	28	4.64	0.0001
	Control Group	15	53.26	6.09			

Based on Table 4, the t value for the pre- and posttest with a df = 28 at the significance level of $p<0.05$ indicates no significant difference between the two groups on pretest in terms of problem-solving speed, while this difference is significant on posttest. In other words: The use of the mathematics educational software affected the students' problem-solving speed.

.There is a difference between the students who use mathematics educational software and those who do not in terms of problem-solving attention and concentration. To test this hypothesis, a t-test was run as follows.

Table 5. T-test for the variable of problem-solving attention and concentration

Variable		Number	Mean	SD	Df	T	Significance level
Problem-solving attention and concentration (Pretest)	Experimental group	15	16.13	1.35	28	1.01	0.31
	Control Group	15	15.53	1.84			
Problem-solving attention and concentration (Posttest)	Experimental group	15	18.80	0.86	28	5.05	0.0001
	Control Group	15	16.06	1.90			

Based on Table 5, the t value for the pre- and posttest with a df = 28 at the significance level of $p<0.05$ indicates no significant difference between the two groups on pretest in terms of problem-solving attention and concentration, while this difference is significant on posttest. In other words: The use of the mathematics educational software affected the students' problem-solving attention and concentration.

There is a difference between the students who use mathematics educational software and those who do not in terms of numerical analysis in problem-solving. To test this hypothesis, a t-test was run as follows.

Table 6. T-test for the variable of numerical analysis in problem-solving

Variable		Number	Mean	SD	Df	T	Significance level
numerical analysis in problem-solving (pretest)	Experimental group	15	17.46	2.06	28	1.81	0.08
	Control Group	15	16.06	2.15			
numerical analysis in problem-solving (posttest)	Experimental group	15	18.93	0.88	28	5.88	0.0001
	Control Group	15	16.20	1.56			

Based on Table 6, the t value for the pre- and posttest with a df = 28 at the significance level of $p<0.05$ indicates no significant difference between the two groups on pretest in terms of numerical analysis in problem-solving, while this difference is significant on posttest. In other words: The use of the mathematics educational software affected the students' numerical analysis in problem-solving.

There is a difference between students who use mathematics educational software and those who do not in terms of problem-solving strategy knowledge. To test this hypothesis, a t-test was run as follows.

Table 7. T-test for the variable of problem-solving strategy understanding

Variable			Number	Mean	SD	Df	T	Significance level
Pattern finding	Pretest	Experimental group	15	3.73	0.35	28	0.77	0.44
		Control Group	15	3.46	0.81			
	Posttest	Experimental group	15	4.86	0.44	28	5.22	0.0001
		Control Group	15	3.66	0.47			
Simple problem-solving strategy	Pretest	Experimental group	15	1.66	0.17	28	0.39	0.69
		Control Group	15	1.60	0.48			
	Posttest	Experimental group	15	1.93	0.48	28	3.53	0.001
		Control Group	15	1.46	0.50			
Shape drawing strategy	Pretest	Experimental group	15	1.66	0.48	28	0.36	0.71
		Control Group	15	1.60	0.50			
	Posttest	Experimental group	15	1.93	0.17	28	4.48	0.0001
		Control Group	15	1.33	0.48			
Guess and check strategy	Pretest	Experimental group	15	3.06	0.88	28	1.48	0.14
		Control Group	15	3.66	1.29			
	Posttest	Experimental group	15	3.66	0.48	28	3.37	0.002

		Control Group	15	2.60	1.12			
Symbolic strategy	Pretest	Experimental group	15	1.53	0.54	28	0.35	0.72
		Control Group	15	1.60	0.50			
	Posttest	Experimental group	15	2	0	28	2.64	0.01
		Control Group	15	1.66	0.48			
Sub-problem strategy	Pretest	Experimental group	15	1.60	1.39	28	0.36	0.71
		Control Group	15	1.66	1.16			
	Posttest	Experimental group	15	1.86	0.35	28	2.92	0.007
		Control Group	15	1.66	0.50			
Pattern making strategy	Pretest	Experimental group	15	1.40	0.50	28	0.71	0.48
		Control Group	15	1.53	0.51			
	Posttest	Experimental group	15	1.86	0.35	28	2.47	0.01
		Control Group	15	1.46	0.51			

Based on Table 7, the t value for the pre- and posttest with a df = 28 at the significance level of $p<0.05$ indicates no significant difference between the two groups on pretest in terms of problem-solving strategy understanding (pattern finding, simple problem-solving, shape drawing, guess and check, symbolic, and pattern making strategy)

while this difference is significant on posttest. In other words: The use of mathematics educational software affects the students' problem-solving strategy understanding (pattern finding, simple problem-solving, shape drawing, guess and check, symbolic, and pattern making strategy).

Discussion and Conclusion

This study aimed to examine the effect of educational software on students' mathematical problem-solving skill. The demographic characteristics of the two groups of students with dyscalculia did not show any difference; in other words, the two groups were homogeneous in this regard. Therefore, a better comparison of the groups was made following the intervention. Based on the findings, the mathematical problem-solving skills were much higher in the experimental group (receiving educational software training) than the control group (receiving routine school education). Herein, we discuss the results of the research hypothesis, and finally, we present practical and research recommendations and discuss the limitations of this study.

Examining the main hypothesis: There is a difference between students who use mathematics educational software and those who do not in terms of problem-solving skill. Table 3 shows that, after adjusting the pretest scores of problem-solving skill in the two groups, the null hypothesis of the lack of difference between the two groups is rejected; in other words, there is a significant difference between the two groups in terms of problem-solving skill, and this difference is due to using the mathematics education software. Therefore, by teaching via educational software, the students' mathematical problem-solving skill can be enhanced.

This result is in line with those of Mana Bazzazi (2016), Paknia et al. (2013), Daeezadeh et al. (2012), and Clark (2008). These studies suggest that the use of educational software helps promote students' academic achievement and active learning motivation in mathematics, but does not affect their creative learning in mathematics. The results of these studies are consistent with ours in that the use of a software was effective on a psychological variable. These students are greatly similar to the present study in terms of variables and results, the difference being that, in the cited studies, the effect of teaching abacus mental calculation was examined on mathematics problem-solving skill.

Secondary hypothesis 1: There is a difference between students who use mathematics educational software and those who do not in terms of problem-solving speed. Based on Table 4, the t value for the pre- and posttest indicates no significant difference between the two groups on pretest in terms of problem-solving speed, while this difference is significant on posttest. In other words, the use of mathematics education software affected the students' problem-solving speed. An important point that should be taught to students, especially in mathematics problem-solving, is how they can find proper solutions to problems; the more skills they have in selecting the proper solution, the faster they find the correct answer. Therefore, becoming a student with high self-confidence who has sufficient skill in choosing a proper solution greatly contributes to their achievement. The results of the present study are compatible with those of Bazzazi (2016), Noroozi (2014), Rezaee Rad (2014), Daeezadeh et al. (2012), Lakdasht et al. (2011), Mirzaee (2010), Jitendra et al. (2016), Demirel et al. (2015), Spears (2011), the results showed that learning mental calculation promotes components such as speed, attention, performance, and memory capacity, which improves skills such as time management, concentration, and problem-solving skill, all of which contribute to students' success in all disciplines and in daily life.

Secondary hypothesis 2: There is a difference between students who use mathematics educational software and those who do not in terms of problem-solving attention and concentration. Based on Table 4-9, the t value for the pre- and posttest indicates no significant difference between the two groups on pretest in terms of problem-solving attention and concentration, while this difference is significant on posttest. In other words: The use of the mathematics educational software affected the students' problem-solving attention and concentration.

Interpretation of the results: Attention is a topic of interest for psychologists and motor behavior researchers. There are diverse attention and concentration exercises. In general, anything that causes a pause and reflection in the child can be regarded as such an exercise, e.g., naming the components of a picture, looking at a specific point for some seconds, or following the flashlight with eyes in a dark room. Accordingly, the use of educational software can be helpful based on the students' needs. The results of this study are in line with those of Bazzazi (2016), Noroozi (2014), Rezaee Rad (2014), Paknia et al. (2013), Lakdasht et al. (2011), Mirzaee (2010), Jitendra et al. (2016). In the study by Abolqassemi (2016), the results revealed that psychologists and teachers should pay special attention to promoting students' attention and concentration as a main factor in reducing their stress and enhancing their mental output. In other words, the lower the stress, the higher the mental output, problem-solving skill, and selection of correct problem-solving strategy. Daresh et al (2017) In their research, they concluded that teaching problem solving skills to students on academic progress

Their math has a positive effect.

Secondary hypothesis 3:There is a difference between students who use mathematics educational software and those who do not in terms of numerical analysis in problem-solving.

Based on Table 6, the t value for the pre- and posttest indicates no significant difference between the two groups on pretest in terms of numerical analysis in problem-solving, while this difference is significant on posttest. The use of the mathematics educational software affected the students' numerical analysis in problem-solving. Numeric analysis refers to the regularization of study and application of approximate calculation methods. These methods are used to solve some continuities (contrary to discontinuities) that cannot be solved by analytic and precise methods. The first treatise in numerical analysis in the modern sense was written by Al-Khwarizmi, and he became so famous that numerical analysis in problem-solving methods was called algorithms after him. With the advancement of computers, there was a greater need for solving mathematical problems by numeric methods. At this time, the efficiency of methods previously proposed by Newton and Euler became salient. Mathematicians and other scientists also contributed to this domain and proposed more efficient methods (Mehri, 2009). In this way, numerical analysis acquired its novel form. In other words, educational software greatly helps the performance of numerical analysis calculation. This study is consistent with those of Bazzazi (2016), Pourabolqassem (2016), Noroozi (2014), Rezaee Rad (2014), Paknia et al. (2013), Daeezadeh et al. (2012), Momeni Mahmooee et al. (2012), Mirzaee (2010).

Secondary hypothesis 4: There is a difference between students who use mathematics educational software and those who do not in terms of problem-solving strategy understanding.

Based on Table 7, the t value for the pre- and posttest indicates no significant difference between the two groups on pretest in terms of problem-solving strategy understanding (pattern finding, simple problem-solving, shape drawing, guess and check, symbolic, and pattern making strategy)

while this difference is significant on posttest. The use of mathematics educational software affects the students' problem-solving strategy understanding (pattern finding, simple problem-solving, shape drawing, guess and check, symbolic, and pattern making strategy). One of the major problems faced by students is that they do not make an effort to solve the problem. That is, when faced with a problem, they do not know where to begin or how to solve it. Teaching problem-solving strategies can be a beneficial step towards problem-solving. Examining different strategies and the possibility of solving problems by using these strategies is, in fact, an important measure for problem-solving. Realizing which strategy is more appropriate is an important point. This study is consistent with those of Bazzazi (2016), Noroozi (2014), Rezaee Rad (2014), (2013), (2012), Momeni Mahmooee et al. (2012), Lakdasht et al. (2011), Mirzaee (2010), Jitendra et al. (2016).

This study was limited by some factors. The first limitation was the small sample. Although there was no attrition in this study, the small sample is a limitation that prevents the precise estimation of the program's effect size. The second limitation has to do with the self-report instruments. These instruments have inherent problems (measurement error, lack of self-observation, etc.). Moreover, the sample comprised only 3rd-grade students; therefore, the results should be generalized with caution. It is recommended that future studies provide placebo programs for the control group to control the expected effect. It is also suggested that larger samples be recruited to calculate the program's actual effect size.

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