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The Effects of using Algodoo in Science Teaching at Middle School

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Abstract: The study examined the effects of instructional approaches as support for scientific learning using a simulation program, Algodoo. The well-known difficulties on learning science concept is supported by Algodoo program. Algodoo is a physic simulation program and it is integrated 7 th grade work and energy unit science classes. The study is conducted at a state school in İstanbul 2017-2018 semesters ,3 instructors and their two classes totally six classes and 202 students participate the study. The study designed as an experimental research. Each instructors' experiment and control group is randomly selected. During the three weeks, each instructors lecture control group with traditional method and experimental group is studied science lessons supported with Algodoo. Pre-test and post –test are applied to all participant as quantative data tools and reflections and worksheets are applied to experiment groups as qualitative data tools. The acquired results show that students have positive attitudes towards Algodoo program they seen lesson which is applied Algodoo more enjoyable and meaningful for them. These kinds of feedback also effect the students' perspective towards science lesson and students 'success. Algodoo can be applied to students from different education levels.

Keywords: Algodoo, Work and energy unit, Simulations

Introduction

Nowadays called as technology era and it comes together many opportunities together. The needs of the society changes and to meet needs of the society the basic aim of the education is bringing up individuals who are qualified. To generate productive people who are enthusiastic to search and ask it is good idea to use advantages of technology. (Teke, Doğan, & Duran, 2015). Growing as a productive people is the main vision of the Turkey's curriculum. (MEB, 2013) The attempt and projects are supported by Ministry of Education to bring forth scientific literate people who can utilize science knowledge and skills to create problem solving and making reasoned decision in real life situation. (R.Soobard & M.Rannikmae, 2015)

In recent years, the development in every discipline has affected education that it causes changing in education system and curriculum. Many attempt and project is conducted by researchers and ministry to meet the need of society and time. FATİH project is one of these attempts. FATİH project is one of the comprehensive project wants to integrate technology to education. (MEB, Fatih Projesi, 2017). Within the scope of this project interactive white boards(IWB) set in the classes and begin the use. Nearly 80% of the school has IWB in Turkey. It is high percentage when it compares the countries. Around 70% of all classroom in Denmark and Netherlands, and more than 50% of classroom in Australia and USA. (Gregorcic, Etkina, & Planinsic, 2017)

Science education has basic elements and concepts are one of them. Concepts can be defined as ideas, objects or events that helps people see the world around. Conceptual understanding permits one to transfer an explanation of a phenomenon to different variants of a situation that have been previously analyzed, is clearly a goal to be recruited under the label learning the science at any level. (Viennot) At some points it's aims is parallel to scientific literacy.

Energy is an important and interdisciplinary concept in science education. It is related to daily life and exists in various forms like; heat, electricity, kinetic energy, light, sound. Despite of familiarity, students have problems with energy concepts. Teachers and students states many reasons why they face with problem with this topic, the emphasis on it is and abstract and complex concept. The teaching procedure of energy concept should be supported by different materials and teaching approaches. Technology is chance to manage this problem. (Bezen, Bayrak, & Aykutlu, 2016)

Energy underpins many topics in science education such as work, power, force, photosynthesis, chemical reactions. It is core subject for science education but it is an abstract concept and both teachers and students have difficulty on setting connection with other topic to energy, transition to real life. (Hırça, Çalık, & Seven, 2011).

The needs of the society and the developments in the society brings with the new requirements during the educational process. The productive combination of needs and technological advantages is suitable way to prepare educational materials that meet the needs of each students. Technology is not an alternative of teachers but it is an advantage comes with time. The effective use of technology in educational process increases the quality of educational materials and educations. Animations, simulations, graphics, audio visual materials are the product of technology which serve to make real educational objectives to students' individual differences and learning styles. (Güven & Sülün, 2012)

Simulations are educational programs that are easy to use and free of expense, so they became the most frequently preferred educational tools which are the product of technology. Simulations both give chance to students to create own virtual world and experience what they want to try. The opportunity to create a discussion with data can be easily design by using simulations. (Silva, 2014)

The examined literature shows that there are applied research about Algodoo and they mostly related with high school students, physic classes and pre service teacher. There is not a research Algodoo with secondary school. The related topic and research question is decided with respect to this gap in the literature and students' need. The topic is selected from 7th grade science curriculum work and power unit.

Method

Participant

Table 1. Number of participant

Class	# of Boys	# of Girls
7/A (A1)	18	15
7/B (C1)	17	17
7/E (C2)	22	12
7/F (A2)	18	17
7/İ (A3)	17	16
7/L (C3)	20	13
TOTAL	112	90

Table 2. Research design

GROUPS	PRETEST	APPLICATION	POSTTEST
CONTROL GROUPS	*TAT*	Traditional Science Education	*TAT*
EXPERIMENT GROUP	*TAT*	Science Education which is Supported by Algodoo Using	*TAT*

Research Design

The study is conducted in a state school in Istanbul. Experimental research design is used in this research. Experimental research design is selected as appropriate research type because it is the best type for testing hypotheses about cause and effects. (Fraenkel & Wallen, 2005). The independent the changes of students are examined with respect to technology attitude test after application of Algodoo in science classes.

Results and Discussion

Results

Table 3. Means and standard deviations of the TAT pre-test and post-test scores

		Pre-test		Post-test	
Class	N	Mean	Standart Deviation	Mean	Standart Deviation
Algodoo1(A1)	33	3,95	0,57	4,24	0,54
Algodoo2(A2)	35	4,18	0,56	4,30	0,44
Algodoo3(A3)	33	4,01	0,55	4,25	0,49
Control1(C1)	34	4,17	0,52	4,41	0,43
Control2(C2)	34	3,91	0,62	4,03	0,69
Control3(C3)	33	4,26	0,58	4,29	0,51

TAT(Technology Attitude Test)

Table 3 shows that the TAT's mean and standard deviation of the control and application groups' pre and posttests. The lowest mean score of pretest is observed C2 group and the highest mean score is observed C3 group. The lowest mean score of posttest is observed C2 and the highest score is observed C1 group. The incensement is in the scores of the Algodoo groups after the intervention. ($Algodoo1_{pre}$ =3,95 $Algodoo1_{post}$ =4,24; $Algodoo2_{pre}$ =4,18 $Algodoo2_{post}$ =4,30; $Algodoo3_{pre}$ =4,01 $Algodoo3_{post}$ =4,25)

Table 4. ANCOVA test results for the effects of Algodoo-based instruction on the TAT

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	17,927[a]	6	2,988	14,619	,006	,310
Intercept	19,375	1	19,375	94,798	,000	,327
Pretest	15,213	1	15,213	74,438	,000	,276
Class	1,345	5	,269	1,316	,259	,033
Error	39,854	195	,204			
Total	3720,302	202				
Corrected Total	57,781	201				

a. R Squared = ,310 (Adjusted R Squared = ,289)

Discussion

The research attempt to examine the effects of using Algodoo in science lessons at middle school. Science education has an important place both education life and daily lives. Science education mostly depend on the understanding and setting relationships between the concepts. In other words, growing scientific literate people the primary aim of science education. (MEB, 2013). Scientific literate people is a need for both society and era. Needs and developments brings with positive and negative features with together so manipulations on each areas are inevitable truths. Education is an ongoing and alive process so integrating new developments into educations especially classes is necessity. Technology integration into classes is one of the attempt to meet the needs of society. The attempt is mostly supported by state and FATİH project is an evidence of this. FATİH project is one of the comprehensive project wants to integrate technology to education. (MEB, 2017). Within the scope of this project interactive white boards(IWB) set in the classes and begin the use. Nearly 80% of the school has IWB in Turkey.

The examined literature shows that using simulations and Algodoo has positive effects on students' science achievement. Energy is an abstract concept and students have problems with this topic. Misconceptions and energy conversion are the mostly problematic part of the topic. To get rid of misconceptions students must be dissatisfied with their existed conceptions; and the new concepts must be intelligible and plausible. At this point serving different information sources to learners is a reasonable way. Technology is a good way to supply different teaching material and sources (Lee, 2014). The study is conducted by Akbulut, Şahin and Çepni(2013) shows that the main reason of misconceptions which are related to energy topic is that students are passive so they do not embodied the topic. To solve this, students should be active during the knowledge acquisition process. (Akbulut, Şahin, & Çepni, 2013) Simulations create chances to students being active in the process and embodied the topic.

Technology usage in classes is a contradictive topic but to meet the needs of society and era the integration of technology into education should be done effectively. Simulations are the applications which are comes with the technology. Algodoo is a simulation application easy to use in the classroom. The study examines the effect of using Algodoo in science classes on technology attitudes.

Students' feedback of Algodoo using in the science classes is positive. They declare that it is enjoyable, playful, observable. The statements show that students are more eager to participate to lessons and they are more active. Teachers are the most important part of education process. However, this does not mean to only they are the active in teaching and learning process. Students should be more active to increase the knowledge acquisition. By using technology teachers can create more student active learning environment. Teachers attitudes play an important role the integration of technology into education. (Rutten, Joolingen, & Veen, 2012)

Algodoo has positive effect on students' attitudes towards technology. The experiment group show higher increasement than control group on technology attitude scores. Algodoo has an easy interface to use. Technology literacy is 21stcentury skill and the improvement of attitudes towards technology is demanded.

Cydis (2015) states that technology integration is a basic feature of students' competence in the technology era. The easy and enjoyable applications make easier to integration of technology into education and increase the students' interest towards technology. (Cydis, 2015) A research which is conducted in Finnish and Estonian schools indicate that Technical craft has an impact on motivation for learning technology. (Autio & Soobik, 2017)

Conclusion

The previous researches shows that using simulations does not have negative effect. Also, the examined results explain the positive relationship between the using Algodoo and knowledge acquisition. The study not only results positive impact on achievement but also different areas like scientific process skills, attitudes towards science and technology. There is significance difference between pre-test and post-test score of the control and experiment group. The higher positive improvement is observed at technology attitude scale of experiment group.

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