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A Comparison of the Elementary Level Students' Attitude Towards Technology by Considering Their Achievement Level in Science

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Abstract: The aim of this study is to compare the elementary education students' attitude towards technology according to their success level in science and technology lesson. The research has been carried out using survey method and the data have been gathered by the help of survey technique. Data of the study have been obtained from 252 students who attend elementary schools in a middle scale city of Turkey. Likert-type scale named as "Scale of Students Attitude towards Technology: Turkish Version" was adapted to Turkish by Yurdagül and Aşkar [23]. Data analysis was made using MANOVA by SPSS. According to results, the general attitude of the students towards technology is positive. In addition, their attitude does not differ significantly according to their class level. However, their attitudes differ significantly according to their success in science and technology lesson. The attitude of the students who get better success in science and technology lesson is higher than the students who get lower scores. Moreover, the students' success level is determined as an effective factor on their attitude.

Key words: Technology attitude · Science and technology · Elementary education

INTRODUCTION

Science and technology are two important and related concepts. These two concepts are first combined within the same lesson in primary level in Turkey since 2005 so as to develop the students' efficiency in science and technology field [1]. In many countries such as England, Canada and the USA science and technology course has been taught together for many years. The purpose of this education starting from primary level is to make the students get ready for the future and develop themselves [2].

The relationship between science and technology is mutual because they affect each other [3, 4]. Students' affective characteristics as well as their cognitive skills are important in development. Bloom has pointed out there are evidences showing the relationship between affective characteristics and cognitive skills [5]. Besides affective characteristics have a great role on determining and affecting the success. Attitude is one of the most important affective factors. In addition, there is a relationship between attitude and academic success in science education has been supported by many researches [6-9]. On the other hand, the level of this relation shows that there are differences in results of those studies [7, 10].

Technological devices are the most commonly used in developing students' knowledge and abilities. According to many different study results, using technology is stated to be very effective in developing students' affective characteristics level in science lessons [11]. As the elementary education students' attitude towards technology is generally positive [12], it should be used as an important factor in increasing the success in science lessons. Because of these, using technology in teaching science and developing technological literacy is significant to better understanding science. Moreover, the technological literacy concept is about understanding the scientific information and using technology appropriately during the process of problem solving [13]. One of the reasons why Turkish students are not very successful in science and technology fields in international exams such as TIMSS [14] and PISA [15] is lack of this kind of characteristics. Establishing the interaction between science and technology will help elementary school

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students develop technological literacy skill which is very important for science classes [16]. Roy has stated that the students' attitude towards science is higher than their attitude towards technology and that the reason for this is the fact that some drawbacks of technology cause contradictions in students' minds [17], whereas these two disciplines has developed together and will develop together [18]. Thus, the students' success in science may be seen as an important variable on their attitude towards technology.

In the studies on technology attitude of pupils there is a frequently used scale in the literature. The scale has been used by researchers from Canada, USA, Mexico, Kenya, Botswana, India and Turkey (over 25 countries) (see Yurdagül and Aşkar). With its importance PATT (Pupils' Attitudes towards Technology) is a focus instrument to study technology attitude in this study [19]. In the studies used this scale the focus has been mainly on gender variable [20]. If the relationship of these two concepts which have been integrated to the primary education program in Turkey in 2005 is considered in view of different variables, it is believed to have a great contribution in development of science education. In this context, the aim of the study is to compare the elementary students' attitude towards science and technology with their success level in class and in science and technology lessons.

MATERIALS AND METHODS

Survey method was used in the study. Data was gathered from the sample by using questionnaire [21].

Sample: Two hundred fifty two elementary students who attend 6 different schools in 2008-2009 academic year are the sample of this study. Two hundred fifty two elementary students who attend 6 different schools in 2008-2009 academic year are the sample of this study. The sample includes 108 female and 144 male students whose ages are between 12 and 16. Seventy students is 6^{th} grade, 69 is 7^{th} grade and 113 is 8^{th} grade.

Data Collection Instrument: Measurement instrument used in the study has been developed by Marc de Vries, Allen Bame and William E. Dugger with the name of PATT-USA in 1988. There are 4 different sections in the scale. The first section has been prepared in order to find out the students' demographic characteristics. The second section includes open-ended question for bringing out students' ideas about technology. The third section consists of 58 entries prepared in Likert type form to measure the students' attitude towards technology. The last section includes 31 items graded as the form of Guttmann scale which present the cognitive aspect of the students' attitude towards technology. This scale was adapted firstly to Turkish and conducted by Deniz, Görgen and Şeker to measure graduate students' attitude towards technology [22]. However, the scale was adapted again by Yurdagül ve Aşkar. It has been explained by Yurdagül and Aşkar that this scale was prepared for the students' at the ages between 10 and 16. This was the reason for adaptation. Therefore, the adapted scale by Yurdagül and Aşkar has been used in this study [23]. The scale developed by researchers was named as SSCT-TV (Scale of Students' Attitude towards Technology: Turkish Version).

The success level of the students was measured by considering previous achievement scores in science and technology course.

Analysis of the Data: Multivariate analysis of variance (MANOVA) was used to analyze the data gathered by the application of the scale. In this design, scores of the sub dimensions of the students' attitude towards technology has been applied as dependent variable, the success of the students and their scales in science and technology lesson have been applied as independent variable.

RESULTS

In this section, the results on the analysis of elementary school students' attitude towards technology will be presented under this section in terms of different variables.

In Table 1, it can be seen that the model of analyses has two independent variables and four dependent variables. In this present study, to what degree the sub-dimensions of students' attitude towards technology differ in terms of different variables. To that end, the students' grade level and science and technology scores have been used as independent variables. To what degree these two independent variables caused differences in the total scores on the scale of the students' attitude towards technology and sub-dimension scores have been tested by the help of MANOVA analysis.

The Box's M value and the level of significance shows that data set is available for MANOVA analysis (*Box's M* = 154.65; $p > 0.05$). According to the results, variance covariance matrix is equal across the groups. That means the assumption of multi-variate analyses of variance on variance covariance matrix equality is provided.

Table 1: Design of the study (MANOVA)

Independent Variables	Dependent Variables
Grade	Tendency towards technology
Science and Technology Score	Drawback of technology
	Contribution and importance of technology
	Technology for everyone

Table 2: Analysis results of covariance matrix equality

Box's M	F	df1	df2	p
154.65	1.18	120	43707.09	0.08

Table 3: Levene test results related to the equality of the error variances of the sub-dimensions of the scale

	F	p
Tendency towards technology	1.14	0.34
Drawback of technology	1.81	0.08
Contribution and importance of technology	0.82	0.59
Technology for everyone	0.92	0.50
Technology attitude total	1.25	0.27

df1=8; df2=243

In regarding to Table 3, the data based on the participants' answers that the students gave about the scale of the students' attitude towards technology has been determined to show equality of the error variances of the sub-dimensions as the second assumption of the analyses. With respect to this result, it can be said that equality of error variance hypothesis which is one of the main assumptions for applying multivariate analysis in the data gathered from the sample has been provided and that variability level of these range is equal for different groups.

Table 4 shows that the factor which the students' attitude towards technology is the highest scores *(M=4.44)* about "contribution and importance of technology". The attitude of the students related to this factor is at the level of "completely disagree". Other three dimensions and total scores are at the level of "agree". The lowest attitude dimension is related with "Drawback of technology". According to these results, it can be asserted that the students' attitude towards technology is generally positive.

According to Table 4, when the students' attitude towards technology, their grades and their scores in science and technology lessons are analyzed, it has been designated that the students who get low scores in science and technology lesson in 6th, 7th and 8th grades have lower averages in comparison with the students get higher scores. When total average scores are viewed it has been stated that the level of attitude towards technology increases in higher grades. When general scores are observed, it has been confirmed that the students from all grades have similar mean scores.

According to the means of all dimensions, it has been stated that the students' attitude increase distinctively as their success in science and technology lesson increases. Nevertheless, it is not the in same direction with the students' grades. According to the data, the mean score which is 3.56 in the 6th grade has been determined to decrease to 3.51 in the 7th grade and increase to 3.60 in the 8th grade. This result can be interpreted in the way that the level of the students' grades where they are being educated is not a significant variable on their attitude towards technology and that the success level in science and technology lesson is an efficient variable.

In Table 5, the students' attitude towards technology differs according to grade and science and technology score and interaction between grade and science and technology score variables has not been observed by MANOVA analysis. According to the results of MANOVA, there is a significant difference between the students' science and technology lesson scores [*Wilk's Lambda (ë)* =.77, F (5-478) = 6.59, p <.05], but it is not significant according to grade and interaction of grade and science and technology lesson score variables. These Findings showing the direction and source of these differences according to the sub-dimensions and the total score of the scale have been presented in Table 6.

It has been asserted that among the students' attitude towards technology according to their grade levels, do not differ significantly in any of the sub-dimensions of the attitude scale and that the effect size (ç2) is quite low. In respect of the total score of the scale, on the other hand, it has been found that there is a significant difference between 7th and 8th grade students' attitude (F=3.88, p< 0.05), but the effect size (ç2=0.3) is low. With respect to ANOVA analysis which has been made to determine the direction of difference occurred in the total score, the difference has been observed to be in favour of 8th grade students.

Among the students' attitude towards technology according to their science and technology scores, it has been determined that there is a significant difference (F=7.69, p< 0.05) related with "tendency towards technology" and that the effect size is high ($ç2$=0.16), there is a significant difference (F=8.72, p< 0.05) related with "contribution and importance of technology" and the effect size is medium ($ç2$=0.07), there is a significant difference (F=5.50, p< 0.05) related with "technology for

Table 4: Descriptive statistic results

	6th Grade			7th Grade			8th Grade			Total		
	n	M	SD	n	M	SD	n	M	SD	n	M	SD
Dimension	Tendency towards technology											
Low	24	3.48	0.75	27	3.57	0.87	42	3.35	0.69	93	3.45	0.76
Medium	27	3.62	0.82	18	3.63	0.77	36	3.87	0.71	81	3.73	0.76
High	19	4.06	0.87	24	3.81	0.85	35	3.96	0.64	78	3.94	0.76
Total	70	3.69	0.83	69	3.67	0.83	113	3.71	0.73	252	3.69	0.79
Dimension	Drawback of technology											
Low	24	2.95	0.91	27	2.93	0.92	42	3.31	0.94	93	3.11	0.93
Medium	27	3.34	0.97	18	3.24	1.06	36	3.83	0.81	81	3.53	0.95
High	19	4.14	0.70	24	3.96	0.54	35	3.82	0.77	78	3.94	0.69
Total	70	3.42	0.99	69	3.37	0.95	113	3.63	0.88	252	3.50	0.93
Dimension	Contribution and importance of technology											
Low	24	4.25	0.47	27	4.22	0.69	42	4.34	0.53	93	4.28	0.56
Medium	27	4.37	0.46	18	4.36	0.58	36	4.49	0.52	81	4.42	0.52
High	19	4.54	0.63	24	4.66	0.32	35	4.69	0.60	78	4.64	0.54
Total	70	4.37	0.52	69	4.41	0.58	113	4.50	0.57	252	4.44	0.56
Dimension	Technology for everyone											
Low	24	3.83	0.80	27	3.54	0.96	42	3.90	0.86	93	3.78	0.88
Medium	27	3.64	0.98	18	3.91	0.66	36	3.94	0.87	81	3.84	0.87
High	19	4.33	0.92	24	4.01	0.84	35	4.23	0.82	78	4.19	0.85
Total	70	3.90	0.94	69	3.80	0.87	113	4.02	0.85	252	3.92	0.88
Dimension	Technology attitude total score											
Low	24	3.34	0.43	27	3.32	0.43	42	3.39	0.42	93	3.36	0.42
Medium	27	3.51	0.41	18	3.45	0.35	36	3.74	0.40	81	3.60	0.41
High	19	3.91	0.50	24	3.77	0.31	35	3.92	0.35	78	3.87	0.38
Total	70	3.56	0.49	69	3.51	0.41	113	3.67	0.45	252	3.60	0.46

Table 5: Two-way MANOVA analysis results related to empirical pattern

Source of Variance	Multivariate Test	Value	df1	df2	F	*p*
Grade	Wilks' Lambda	0.96	5	478	.95	0.48
Science and technology score		0.77	5	478	6.59	0.00
Grade* Science and technology score		0.89	10	793	1.46	0.09

Table 6: Two-way MANOVA analysis results related to the effect of the variables take part in the empirical pattern

Source	Dependent Variable	Sum of Squares	df	Mean Squares	F	p	Eta Square (η^2)
Grade	Tendency towards technology	0.16	2	0.08	0.14	0.87	0.00
	Drawback of technology	3.47	2	1.74	2.35	0.10	0.02
	Contribution and importance of technology	0.74	2	0.37	1.26	0.29	0.01
	Technology for everyone	1.76	2	0.88	1.18	0.31	0.01
	Technology attitude total	1.25	2	0.63	3.88	0.02	0.03
Science and technology score	Tendency towards technology	8.96	2	4.48	7.69	0.00	0.06
	Drawback of technology	33.11	2	16.55	22.45	0.00	0.16
	Contribution and importance of technology	5.13	2	2.57	8.72	0.00	0.07
	Technology for everyone	8.24	2	4.12	5.50	0.01	0.04
	Technology attitude total	10.62	2	5.31	32.98	0.00	0.21
Grade* Science and technology score	Tendency towards technology	2.73	4	0.68	1.17	0.32	0.02
	Drawback of technology	6.43	4	1.61	2.18	0.07	0.04
	Contribution and importance of technology	0.17	4	0.04	.14	0.97	0.00
	Technology for everyone	2.69	4	0.67	.90	0.47	0.02
	Technology attitude total	0.57	4	0.14	.89	0.47	0.01
Error	Tendency towards technology	141.67	243	0.58			
	Drawback of technology	179.19	243	0.74			
	Contribution and importance of technology	71.54	243	0.29			
	Technology for everyone	181.98	243	0.75			
	Technology attitude total	39.11	243	0.16			
Total	Tendency towards technology	3588.72	252				
	Drawback of technology	3310.82	252				
	Contribution and importance of technology	5043.89	252				
	Technology for everyone	4076.33	252				
	Technology attitude total	3308.99	252				

Table 7: Post-hoc test results

Dimension	Post-hoc test	Grade Level	p	
Technology attitude total	Bonferroni	8	7	0.04
		Success Level		P
Tendency towards technology	Bonferroni	Medium	Low	0.05
		High	Low	0.00
Drawback of technology		Medium	Low	0.00
		High	Low	0.00
		High	Medium	0.01
Contribution and importance of technology		High	Low	0.00
		High	Medium	0.03
Technology for everyone		High	Low	0.01
		High	Medium	0.03
Technology attitude total		Medium	Low	0.00
		High	Low	0.00
		High	Medium	0.00

everyone" ant the effect size is low ($ç2$=0.04). It has been presented that total attitude scores of the students according to their science and technology scores show significant difference (F=32.98, p< 0.05) and the effect size is higher than all the other sub-dimensions ($ç2$=0.21).

Table 6 shows that according to the interaction between grade level and the students' success in science and technology lesson, there is no significant difference among their attitude towards technology. Eta square values show that the effect size on the interaction of these two dependent variables has low.

Post – Hoc test has been made in order to find out which grade levels show significant differences among the students' total attitude scores. Since, Bonferroni test has been used as a Post-Hoc test. Table 7 shows the results which have significant differences.

Test results have shown that there is a significant difference (p <.05) in the scores of 7th and 8th grade students according to their total scores. 8th grade students perceive the level of attitude towards technology higher than 7th grade students do. With respect to all dimensions of the measurement instrument and total score, the scores of the students who are more successful in science and technology lesson has been observed to show significant difference compared to the ones who have low scores in science and technology lesson (p <.05). According to "contribution and importance of technology", "technology for everyone" and total score, it has been stated that the scores of the students who have high scores in science and technology lesson show significant difference when compared to the ones who have medium scores (p <.05). In respect of "tendency towards technology", "drawback of technology" and total score, it has been determined that the scores of the students who have medium scores in science and technology lesson show significant difference when compared to the ones who have low scores (p <.05). According to these results, it can be said that the technology attitude of the students who get high scores in science and technology lesson is higher than the ones who have medium or low scores in that lesson. Moreover, in according to some dimensions of the scale, the attitude of the students who have medium scores is higher than the students who have low scores.

DISCUSSION

When the results of this study are compared to the other similar researches in the literature, they have similar results. On the other hand, results show some differences from existence literatures. The results of this study generally show that there are differences among the elementary students' attitude towards technology according to their success in science and technology lesson. They also show that grade level variable cannot be taken as an important variable about the students' attitude towards technology.

It has been determined that the students' attitude towards technology does not generally show a significant difference according to their grade levels. There has been stated to be a significant difference only among total attitude scores of 7th and 8th grade students. In the study carried out by Becker and Maunsaiyat, it has been specified that there is no significant difference among the attitude of the primary students in Thailand according to their grade levels [24]. This can be for the fact that technology enters people's lives in their very early ages and each student gets the benefit of these opportunities to some extent. When looked at the Table 6, the heights effect size values as an indicator of practical significance were found for the sub-dimensions of "Technology attitude total" and "Drawback of technology".

In several studies it has been stated that science and technology are strongly related to each other directly or indirectly [25-28]. In the study carried out by Eijkelhof et al., it has been expressed that the technology dimension added to the program in The Netherlands firstly in 1993 is an important phase in improving the primary students' attitude despite the problems during practice [11]. Treagust and Rennie claimed that the students' attitude towards technology is generally positive [29]. Moreover they stated that this improvement may go further by the help of science lessons and teachers. Similarly, the results of this study show that the technology attitude of the students who have high scores in science and technology lesson is higher than the ones who have low scores. Osborne who says that the future of modern communities is connected with how they use science and technology has stated that school programs need to be attentive about this [4]. Not only the students but also the teachers should improve themselves about this subject. In the study of Yalvac et al., they have stated that teacher nominees have critical delusions about the related subject and these delusions are mainly about technology [30]. The reflection of these findings related with the teacher nominees may be very effective.

It is not realistic to hope that the contribution and positive results of the new study will appear in the short run. The effects of a program might be understood after several years. It is hoped that the change in science and technology program will increase the success in the field of science. According to the results of this current study, the students' having positive attitude towards technology can be undertaken as a facilitator of this improvement. It can be assumed that it will be effective in improving the future success if the science and technology teachers have more positive attitude towards the new program compared to the old one [31] because it has been brought up in various studies that the applications of the teachers in science lessons have a direct effect on the students' outcomes [32, 33]. It can be said that it will affect the students' success in science and technology lesson positively on the condition that the new program affects the teachers' attitude positively. According to the results of the study, science success level of the students is an important contributor to the attitude towards technology therefore it can be said that the higher scores the students have on achievement, the higher scores the students will have on attitude towards technology.

The fact that the results of the study cannot be generalized for the whole country because of the sample's inefficiency for reflecting the scope completely is seen as a limitation. It can be said that this limitation can be taken away to some extent if similar studies are carried out in different regions and cities. Moreover, studying different variables apart from the ones dealt in this study can be said to contribute to the knowledge in the field of science and technology. In spite of these limitations, the findings of the study show that designing technology-based activities so that the students learn science and technology subjects clearly and having a good interaction between science and technology will help the students improve emotional and mental skills.

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