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ATTITUDES OF THE PARENTS TOWARDS THE SCIENCE LESSON; RELIABILITY-VALIDITY STUDY

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ABSTRACT

It is important to determine the attitude which is an indicator of emotions for a lesson. In particular, the development of the scale to be used to determine the attitude of the parents towards the science lesson will contribute to the field. The aim of this study is to develop a scale for use in determining attitudes of the parents towards the science lesson. The scales were applied to 389 parents of the 6th, 7th and 8th grades students. SPSS and LISREL programs were used to analyze the data. The reliability values and exploratory factor analyzes of the scales were calculated with the help of SPSS program. Cronbach Alpha value, Kaiser-Meyer-Olkin and Bartlett tests were performed at this stage. Afterwards, confirmatory factor analysis was performed with the help of LISREL program and compliance indices of the scales were determined. Then, independent sample T-Test and one-way ANOVA tests were used to answer the research questions. As a result of analyzes, the reliability and exploratory factor analysis of the scale were all acceptable. In addition, the confirmatory factor analysis pattern table values are acceptable but some of the compliance indices are below the acceptable values. As a result, a scale was developed to determine the attitudes of the parents towards the science lesson. According to the average of the attitude scores, it was discovered that the attitudes of the parents towards the science lesson were at a good level. In addition, there was no relationship between the demographic structure of parents and their attitudes towards the science lesson.

Keywords: Science lesson, attitudes, attitudes scale, parents, factor.

INTRODUCTION

The science lesson is a branch of science that provides the basic laws of nature, the properties of matter and living things and the understanding of physical phenomena (Gülen, 2018). In addition, this lesson is given to the student to understand the multi-faceted and dynamic structure of scientific initiative in school life (Khalick, 2005). The student obtains this information during his / her school life. They use this information both in daily life and in family environment. The student questions the function of the information in accordance with the nature of science with his family. Thus, the family learns or learns the knowledge acquired in the science lesson.

Parents accompany the pupil to science subjects depending on their level of education, occupation or interests. In time, emotional situations occur between parents and the science lesson. Some parents show positive thoughts towards this lesson, while others can show negative thoughts (Petty and Cacioppo, 2018). There are parents who are as curious as the students or thinking about what they can learn but some of them may be insensitive. Parents may have responsibilities, sensitivities and satisfaction against this lesson. This is the attitudes which are positive or negative emotions developed towards the science lesson of the parents (Zacharia, 2003).

Attitude is the symbol of the individual's emotional behavior. Because it is a mental activity, it cannot be observed from the outside. It is abstract. In general, there are many studies on attitude. In fact, it is both a mystery and a curiosity. What is an attitude? Why do people have attitudes? How are attitudes measured? Do attitudes predict behaviors? and How is attitude change studied experimentally? Answering these questions has been the focus of attention for researchers. Because of the perception of attitudes will be created by answering these questions (Balçın, 2018; Koballa, 1988).

1. What is an attitude? It is a mental concept that represents feelings expressed as positive or negative against any situation. Attitude determines the behavior that occurs depending on the belief system. As a matter of fact, the attitudes of beliefs affect their intentions in attitudes. In general, attitudes are behavioral learning that can be learned and strengthened over time (Petty and Cacioppo, 2018).

2. Why do people have attitudes? Attitudes, which are appropriate symptoms of our beliefs, help others to know what to expect from us. In other words, it helps others to anticipate the kinds of behavior that we are going to be busy with. Therefore, scientific studies on this subject aim to make scientific data more predictable (Koballa, 1988).

3. How are attitudes measured? Attitudes can be measured in two ways; Direct or indirect. In the direct measurements, the attitude is determined from the individual data is given about himself. For example Likert-style survey applications. In the case of indirect ones, storytelling or drawing is required to determine the

attitude of the individual. Indirectly, attitudes can be determined because people convey their feelings to the stories or pictures which are they tell (Lachapelle and Brennan, 2018)

4. Do attitudes predict behaviors? Attitudes of the individual affect their behavior. In particular, it is known that marketers determine people judgments about the products in their studies and they do advertising works and consequently increase their sales (Zacharia, 2003).

5. How is attitude change studied experimentally? Attitudes can be measured by means of high reliability and validity tools. In this way, the behavior of the individual is estimated. Apart from these, recent studies are about the interchangeability of individual attitudes. It is suggested that the attitudes can be changed by experimental studies. The validity and reliability values of these experimental studies should be very high and a significant difference should be established (Petty and Cacioppo, 2018).

These basic questions used to determine attitudes have inspired many researches. In this study, it is aimed to develop a scale that can be used in attitude determination. In particular, it is thought that the development of a tool that can be used to determine the attitude of parents will contribute to the field. In general, parents see both the teacher and the lesson as data that information to pass and used in daily life (Çubukçu et al., 2016). In addition, the lack of a measurement tool that can determine the attitudes of the parents towards the science lesson is important for the study. Moreover, the attitudes of the parents towards a lesson; influences teachers, students and school. But in general, parents have a lack of attitudes towards school and students (Akbaba Altun, 2009; Çelikten, Şanal and Yeni, 2005). For this reason, the reliability and validity of a measurement tool that can determine the attitudes of the parents towards the science lesson is done in this study.

Purpose of the Research

Purpose of the research; develop a scale to determine the attitudes of parents towards the science lesson and to investigate the relationship between the parents' demographic structure and attitudes towards the lesson. The answers to the following questions were sought within this aim.

A) Can a scale be developed to determine the attitudes of the parents towards the science lesson?

1. Are the reliability values of the scale acceptable?
2. Are the explanatory factor analysis values of the scale acceptable?
3. Are the compliance index values of the scale acceptable in the confirmatory factor analysis?
4. Are the pattern table values in the confirmatory factor analysis of the scale acceptable?

B) What is the attitudes level of parents towards the science lesson?

C) Is there a significant relationship between the demographic structures of parents and their attitudes towards the science lesson?

1. Is there a difference between the gender and attitudes of parents?
2. Is there a difference between the age and attitudes of parents?
3. Is there a difference between the education of parents and their attitudes?
4. Is there a difference between the profession and attitudes of parents?
5. Is there a difference between the duration of parenting and attitudes?

Limitations of Research

Research is limited to a secondary school 6th, 7th and 8th grade student's parents. The study is limited to the development of a scale that can be used to define parent's attitudes for the science lesson. Study implementation only public school in Marmara region.

METHOD

The survey model was used in the study. Survey models are investigations aimed at describing the past or the present situation study. These studies are carried out on large groups (Karasar, 2009). In addition, scale development steps/stages were followed in the study (DeVellis, 2003; Karakoç and Dönmez, 2014). These stages have been used to achieve the result as in the following steps. In the study, the parent's attitudes scale for the science lesson was developed. The study was carried out in five stages. These stages are presented in detail in Table 1.

Table 1. Stages Followed in the Study

A	**Preliminary Study**	**D**	**Reliability and Validity Study**
	Literature review		Reliability study
	Determination of features		Validity Study
	Determination of dimensions		Data analysis
B	**Scale Preparation**	**E**	**Implementation Results**
	Writing scale items		Results by reliability and validity
	Expert opinion		Results by demographic attitudes
	Arranging the scale		Final status of scales
C	**Implementation**		
	Implementation of scale		

Preliminary Study

At this stage of the study, a literature survey was conducted to develop the parent's attitudes scale. Previous studies have been examined. Then, the characteristics of attitudes were determined. In addition to the features presented in the introduction of the study, all data containing attitudes feature were collected in a pool. The collected data are dimensioned according to the characteristics of attitudes. According to this, dimensions were determined "*responsibility*", "*satisfaction*" and "*sensitivity*" abilities in prepared scales.

Scale Preparation

At this stage, the scale items were written. The scale consisting of 40 items was reduced to 30 items as a result of expert opinion. The 30-item scale was examined in terms of language, spelling and meaning to a group of 15 teachers. With the latest regulations, the number of items of the survey has been renewed as 20.In the writing of the scale items; both a science teacher and two field experts were assisted. Scale prepared in likert style. In addition, marked "*strongly disagree*", "*disagree*", "*unstable*", "*agree*" and "*strongly agree*" consists of five options.

Implementation

The parent's attitudes scales were applied. The scale was applied to the parents of middle school students in a public school in the Marmara region. 389 parents are participated in the survey as a volunteer.

Reliability and Validity Study

The reliability and validity studies of the scales and the results of the analysis of the scales data are presented in the findings section.

Implementation Results

At the end of the study, the data about the last state of the scales, reliability and validity and demographic attitudes in the samples were obtained. These data are presented in the findings section and explained in the conclusion section. As a result of the reliability and validity studies, the item number of the scale was 15.

Working Group

The implementation of the study was carried out in a public school located in the Marmara region. Likert scale was applied to 391parents. Since two parents leave blank some of the items in the option scale, their data has not been processed.

Table 2. Number of Students Participating in the Research

	Female	**Male**	**Total**
Scale apply	214	174	389
One participant did not specify his / her gender.			

As shown in Table 2, a total of 389 parents (214 female and 174 male) participated in the implementation. The reason for the large number of female participants is that women are often employed as parents of students.

Data Analysis

SPSS and LISREL programs were used to analyze the data. All data were calculated with the help of SPSS program to the reliability values and exploratory factor analyzes of the scales were calculated. Cronbach Alpha value, Kaiser-Meyer-Olkin (KMO) and Bartlett tests were performed at this stage. After that, confirmatory factor analyzes were performed with the help of LISREL program. Then, independent sample t-test, one-way ANOVA tests were conducted to answer the research questions. In the analysis of the attitude scores of the parents, the following scale values were used. Also Table 3 was used to interpret attitude scores.

Table 3. Criteria values used to interpret attitude scores

Order	Value	Range
1	Very bad	1-1.79
2	Bad	1.80-2.59
3	Middle	2.61-3.39
4	Good	3.40-4,19
5	Very good	4.20-5.00

As seen in Table 3, five equal intervals were determined because the questionnaire was quintet likert style. According to this, it is "*very bad*" between 1-1.79, "*bad*" between 1.80-2.59, "*middle*" between 2.61-3.39, "*good*" between 3.40-4.19 and "*very good*" between 4.20-5.00 range.

FINDINGS

The data obtained in this section are presented in three parts. Significant about parent's attitude and validity values of the scales were given after the reliability values. In addition, data related to the level of significance of the scores obtained are presented.

Reliability

Cronbach's alpha values were examined for the reliability of the factors. According to analyze the reliability value of the scale was calculated as 0.86. In addition, the dimension of the scale Cronbach's alpha values was calculated. According to this values are responsibility 0.67, satisfaction 0.79 and sensitivity 0.74 as calculated.

Validity

The values calculated as a result of exploratory factor analysis within the framework of the validity studies of the parent's attitudes scale for the science lesson are given in Table 4.

Table 4. Calculated Values of Exploratory Factor Analysis

	Acceptable Value	Attitudes	Factor
Kaiser-Meyer-Olkin (KMO)	≥0.50	0.89	doable
Bartlett's Test of Sphericity	≥N	1847,896	doable
p	≤0.05	0.000	doable

As seen in Table 4, the KMO values of scales are above the acceptable value. Bartlett's Test of Sphericity test values show high jump values depending on the number of participants. Finally, "*p*" significance indicates that the data are meaningful (Field, 2000). The values in Table 4 and Table 5 show that this scale can be taken to confirm factor analysis.

Table 5. Factor Load Values

Dimensions	Order	Items	Total variance explain	Total variance (%)
Responsibility	1	I know how many hours a week my child is taking about science lesson.	0.75	35.91
	2	I talk to my child's science teacher	0.67	
	3	Tell me what my child is doing in science lesson	0.97	
	4	Science lesson informs to my child about technological developments	0.87	
	5	I observe the exchange of knowledge between the beginning and the end of education in my child's science lesson	0.86	
Satisfaction	6	My child is doing science lesson homework	0.83	
	7	Science lesson homework helps my child learn	0.70	
	8	I believe that science lesson is productive at school	0.64	
	9	I am satisfied with my child's education in science lesson	0.64	
	10	I think my child likes the science lesson	0.52	
Sensitivity	11	I'm learning something from my child through the science lesson	0.51	
	12	I know the benefits of science lesson to society	0.46	
	13	I know the usefulness of science lesson in daily life	0.41	
	14	I know the science lesson allows us to recognize the organism.	0.36	
	15	I know that the science lesson teaches my child our place in the universe	0.31	

As can be seen in Table 5, it shows a value between 0.67 and 0.97 in the responsibility dimension. It shows a value between 0.52 and 0.83 in the dimension of satisfaction. In the sensitivity dimension, it shows a value

between 0.31 and 0.51. These data indicate that the cargoes are at a good level (Seçer, Halmatov, Gençdoğan, 2013; Yıldırım, 2015).

Table 6. Compliance Indexes Calculated by Confirmatory Factor Analysis

Compliance Indexes	Acceptable Value	Attitudes
Chi-Square / Degree of Freedom	≤3.00	5.51
GFI	≥0.90	0.86
AGFI	≥0.80	0.81
NNFI	≥0.90	0.83
CFI	≥0.90	0.86
RMSR	≤0.10	0.3
RMSEA	≤0.06 or ≤0.08	0.108

GFI = goodness-of-fit index; AGFI = adjusted goodness-of-fit index;
NNFI = non-normed fit index; CFI = comparative fit index;
RMSR = root mean square residual; RMSEA = root mean square error of approximation.

When the Table 6 is examined, it is determined that the majority of the values of the results of implementation are not acceptable value but its close the acceptable value. In addition, the scale's pattern charts and all other data values can be used because of the acceptance of these values (Schermelleh-Engel, Moosbrugger, and Müller, 2003). Although the values shown in the table are below the acceptable values, they are accepted as acceptable because they are close to these values. Indeed, similar examples exist in the literature (Aktaş, 2019; Gülen, 2019). It is also known that achieving acceptable values in such surveys depends on the number of participants. As a matter of fact, it can be said that it is reproducible in other studies by increasing the number of participants. Based on these data, the pattern charts of the scales are given below.

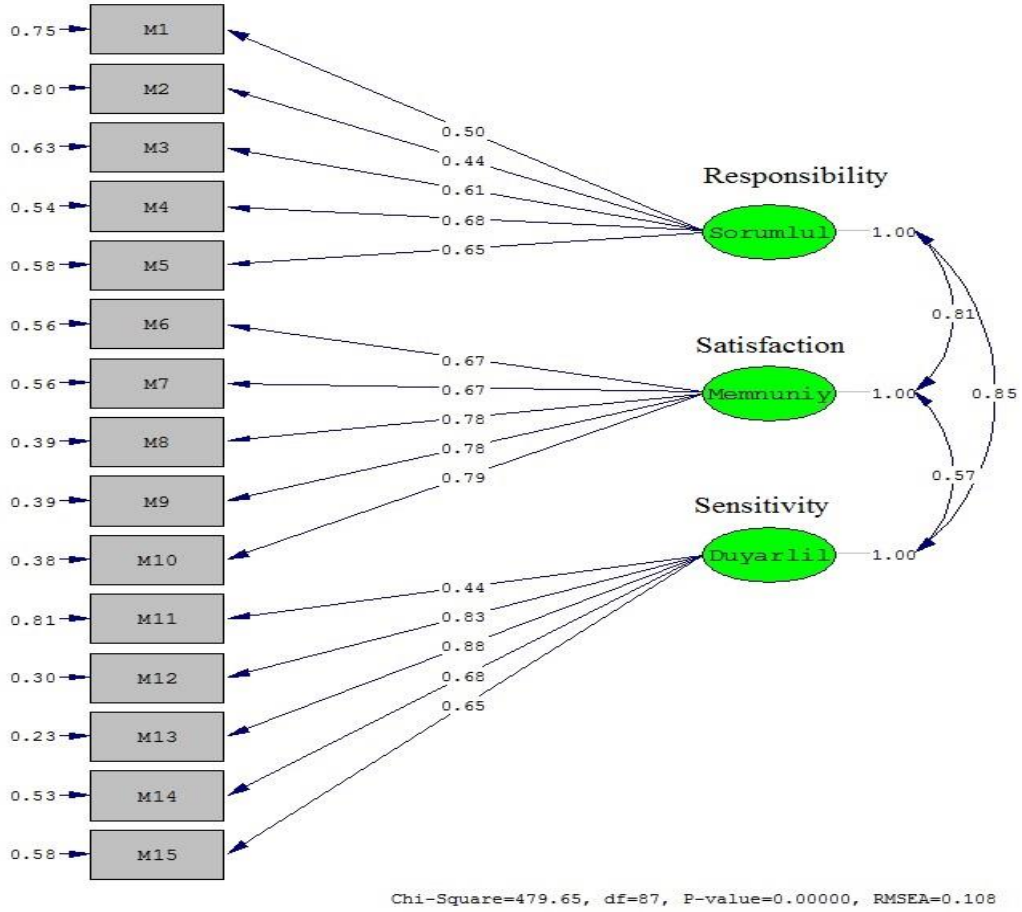

Figure 1. Parent's attitudes scale factor loads and pattern chart in science lesson

Figure 1 shows a pattern chart of the scale. When the relationship between the dimensions of the scale was examined, it was observed that responsibility and satisfaction 0.81, satisfaction and sensitivity 0.57 and responsibility and sensitivity 0.85 were double-sided relationships between the dimensions. The error variances of the substances are given to the left of Figure 1. Factor loads related to substances are shown on the unidirectional arrows that move from the dimensions of the scale to the scale items.

Significant

The attitudes of parents towards the science lesson and the relationship between parents' demographic structures and attitudes are given below.

As shown in Table 6, the scores obtained in the attitude scale were interpreted according to the intervals in Table 3. Accordingly, it is understood that the attitudes of the parents towards the science lesson are "*good*" at all dimensions. And in general parent's attitude is "*good*".

Table 7. Interpretation of the mean scores obtained in attitude scale

Order	Dimensions	Average	Comment
1	Responsibility	3,85	Good
2	Satisfaction	4,34	Good
3	Sensitivity	4,03	Good
4	General	4,07	Good

This study also examined the relationship between gender and scores as evidence of the validity of the scale scores.

Table 8. Independent Samples T-Test for Meaning of Scores by Gender

Scale	Gender	N	X	Standard deviation	df	t	p
Attitude	Male	174	4.01	0.62	386	-1.78	0.076
	Female	214	4.12	0.62			

When Table 8 is examined, it is seen that "*p*" value of scale is high than 0.05.Thus, there is no correlation between gender and attitude values.

Table 9. ANOVA tests for meaning of scores by parent's age

Scale	Age	N	X	Standard deviation	df	f	Homogeneity	p
Attitude	25-30 age	38	4.28	0.61	385	1.95	0.10 (p> 0.05 should be)	0.101
	31-40 age	247	4.03	0.61				
	41-50 age	92	4.04	0.62				
	51-60 age	7	4.73	0.35				

Table 9 shows the relationship between the age and attitudes of parent's. Accordingly, although a homogeneity value is appropriate, p value is greater than 0.05 because there is no significant relationship. The age range of the parents is due to the socio-cultural structure of the region. As a matter of fact, it has received migration from the Black Sea and Eastern regions. In addition, early marriages are made in these regions.

Table 10. ANOVA Tests for Meaning of Scores by Parent's Education

Scale	Education	N	X	Standard deviation	df	f	Homogeneity	p
Attitude	First + Middle	256	4.04	0.64	384	0.256	0.34 (p> 0.05 should be)	0.94
	High school	91	4.10	0.59				
	College	18	4.05	0.52				
	License	4	4.30	0.61				
	Master	1						

Table 10 shows the relationship between the education and attitudes of parent's. There is no significant relationship because the "*p*" value is large, although a homogeneity value is appropriate.

Table 11. ANOVA Tests for Meaning of Scores by Parent's Profession

Scale	Profession	N	X	Standard deviation	df	f	Homogeneity	p
Attitude	Government official	19	3.99	0.65	383	1.283	0.86 (p> 0.05 should be)	0.27
	Private sector workers	56	4.07	0.55				
	Self-employment	91	4.00	0.64				
	Housewife	171	4.10	0.61				
	Not working	12	3.77	0.68				
	Other	35	4.20	0.66				

Table 11 shows the relationship between the profession and attitudes of parent's. Accordingly, although a homogeneity value is appropriate, "*p*" value is greater than 0.05 because there is no significant relationship.

Table 12. ANOVA Tests for Meaning of Scores by Parent's Years

Scale	Parent's years	N	X	Standard deviation	df	f	Homogeneity	p
Attitude	4-5	140	4.08	0.58	375	1.392	0.21 (p> 0.05 should be)	0.25
	6-7	94	3.96	0.64				
	8+	141	4.13	0.63				

In Table 12 the relationship between the parent's years and attitudes of parent's. There is no significant relationship because the "*p*" value is large, although a homogeneity value is appropriate. The parenting year refers to the period starting at primary level.

DISCUSSION

This section is explained below in the order of the research questions.

Table 13. Describing the results of research questions

A	Sub questions related to reliability and validity	Acceptable
1	Are the reliability values of the scale acceptable?	Yes
2	Are the explanatory factor analysis values of the scale acceptable?	Yes
3	Are the compliance index values of the scale acceptable in the confirmatory factor analysis?	Close the acceptable level

4	Are the pattern table values in the confirmatory factor analysis of the scale acceptable?	Yes
B	**Attitudes level of parents towards the science lesson**	**Good**
C	**Sub questions related to demographic and attitude**	**Significant**
1	Is there a difference between the gender and attitudes of parents?	No
2	Is there a difference between the age and attitudes of parents?	No
3	Is there a difference between the education of parents and their attitudes?	No
4	Is there a difference between the profession and attitudes of parents?	No
5	Is there a difference between the duration of parenting and attitudes?	No

Table 13 presents the status of research questions. It can be seen that the majority of the scale value used in the study is acceptable. Thus, parents' attitude scale can be said to be prepared in this study. In addition, the relationship between the parents' demographic structure and scores; it can be said that there is no significant relationship between all characteristics of demographic structure and scores.

***Sub Questions Related to Reliability and Validity**:* First of all. Cronbach's alpha value of the scale was 0.86. In addition, the dimension of the scale Cronbach's alpha values are responsibility 0.67, satisfaction 0.79 and sensitivity 0.74 was calculated. These values show that the scale give reliable results (Büyüköztürk, Çokluk and Köklü, 2013; Buyruk and Korkmaz, 2016). Also, exploratory factor analysis values were calculated as KMO 0.89 (≥0.50), Bartlett's Test of Sphericity 1847.896 and p value was 0.000 (≤0.05). These values can be said to be acceptable values (Aytaç and Öngen, 2012). Accordingly, the scale; Chi-Square / Degree of Freedom 5.51 (≤3.00), GFI 0.86 (≥0.90), AGFI 0.81 (≥0.80), NNFI 0.83 (≥0.90), CFI 0.86 (≥0.90), RMSR 0.3 (≤0.10) and RMSEA 0.108 (≤0.06 or ≤0.08) was calculated as. These data can be said to be not acceptable values but this values are close the acceptable (Kaner, Büyüköztürk and İçeri, 2013; Kızılkaya and Aşkar, 2009; Tosun, 2013).Other than the above values when the patterns of the scales are examined, it can be said that all the data are suitable (Karakoç and Dönmez, 2014). As shown in Figures 1 the items below 0.30 were removed from the scale and their validity was increased. It was determined that the values of scale were acceptable. Researchers such as Tezbaşaran and Gelbal (2018) obtained similar results. In addition Şeker and Saygı (2013), Yüksekbilgili (2016), Kuzu and Demir (2015), Polat and Erişti (2018) all values of the scales were found to be acceptable in their study.

Attitudes Level of Parents towards the Science Lesson: As a result of the interpretation of the attitude points of the parents towards the science lesson, it can be said that the attitudes of the parents towards the science lesson are at a good level. Similarly, Lachapelle and Brennan (2018), Topkaya and Büyükgöze Kavas (2015), Ogilvie, Trusk and Blue (1999), Gökyar and Türkoğlu (2018) found results about the attitude in their study. Güven and Sülün (2012) did not discover a good level attitude in their studies. The reason for this is that the attitude determination studies should not be instantaneous, or rather; long-term activities should be done to determine the attitude. Karatay (2011) found good attitudes in the long experimental process.

***Sub Questions Related to Demographic and Attitude**:* There is no significant relationship between parents' attitude scores and demographic values such as gender, age, education, profession, and parent's years. Although the data were homogeneous, p values were not significant. This shows that there is no relationship between parents' attitudes towards science lesson and demographic structures. Similarly, Bozkırlı and Er (2011), Morán-Soto and Benson (2018), Çakmak and Taşkıran (2014) found no relationship between demographic structures and attitudes. In addition, Erkan and Sop (2018), Balçın (2018) and Çalıkoğlu (2014) did not obtain any meaningfulness in their study. However, Kubat (2018), Doymuş, Şimşek and Bayrakçeken (2004), EL-Daou (2016) in their study, they determined that they have increased their attitudes towards the science lesson. All this work outside; Balçın (2018), Çakmak and Taşkıran (2014) found no significant relationship between gender and attitude. But Balcı, Uyar and Büyükikiz (2012) found that female students have higher attitudes than male students.

CONCLUSION AND RECOMMENDATIONS

According to the reliability and validity results (Cronbach Alpha value, 0.86), a scale that can be used to determine the attitudes of the parents towards the science lesson is developed. It is important to determine the way parents perceive the science lesson. It is recommended that the number of participants should be higher in such studies, as some values in the scale's compliance indexes are lower than acceptable levels.

According to the average of the attitude scores, it was discovered that the attitudes of the parents towards the science lesson were at a good level. It is generally said that the attitudes of the parents towards the lesson are low. As a result of this research, it was discovered that parents have a good attitude towards the science lesson. It is thought that the attitudes of the parents towards the science lesson will increase the interest of the students. Long-term experimental studies are recommended to increase the level of attitudes towards the parents' science lesson.

It was determined that there is no relationship between parents' attitudes towards science lesson and demographic structures. It was determined that the parent's demographic structures such as gender, age, education and profession did not affect the attitudes towards the science lesson or there was no relationship between them. It is considered that the demographic structures of the parents and their attitudes towards the lesson will be investigated separately. It is recommended to determine the situation between the demographic structures and the attitudes by qualitative research.

Compliance with Ethical Standards:

***Funding**: This study was not funded.*

***Ethical Approval**: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.*

***Informed Consent**: Informed consent was obtained from all individual participants included in the study.*

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