Attitude Towards Physics Lessons And Physical Experiments Of The High School Students

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Abstract
In order that students can develop researching, questioning, critical thinking, problem solving and decision making skills, so that they become lifelong learning individuals, they should be improved regarding their knowledge, understanding and attitude towards natural sciences. Attitudes towards physics lessons and physical experiments of high school students have been examined for this purpose. The research has been designed as a scanning study, population of which consists of high school students (9^{th}, 10^{th} and 11^{th} grades) from the schools in the Kayseri province centre. Sample of the study is the 295 students selected among the population by random sampling. A questionnaire including 12 items regarding students' attitude towards physics lessons and 8 items regarding physical experiments were used in the study. Acquired data have been analyzed by using SPSS 16.0 software. Appropriate statistical methods were used for examination of data distribution. Reliability factor of the test is found to be as Cronbach's Alpha=0.73. It was found those students' attitudes towards physics lessons and physical experiments were 63.07, which is some higher than the indecisive level, 60 in this research. Same of the students are indecision about physics lessons and physical experiments, and also, there are as many students of negative opinion as those with a positive opinion. Furthermore, it was examined whether general attitude towards physics lessons and physical experiments of the students varied with respect to gender, grade and age variables, and no significant variation with respect to gender was found. It was determined that students' grade and age differences effect on students' attitudes.
Keywords: High School, Physics Education, Physical Experiments, Attitude.

Introduction

As a science, Physics plays an important role in explaining the events that occur in the universe. In all events that around us can be found physical laws and principles. The developments in physics in the 20^{th} century, it has been extremely successful in that it also greatly benefited to the other basic and applied sciences from these developments (Fishbein 1975). Although physics is in every area in our life and facilitate our lives, national and international studies show that success in physics education is lower than other disciplines (Gok and Silay 2008; Dieck 1997; Rivard and Straw 2000, Mattern and Schau, 2002).

In physics education, various methods and techniques can be used according to the content. Laboratory methods, which are the mostly used method that provides permanent learning, is an educational method encouraging mental activities and allowing students to work individually or in groups (Stack 1995). Laboratory methods ensure that students learn ways to use the knowledge with this method rather than memorizing it. Students improve their skills to better understand of concepts, and adapt them to daily life as well as their personal skills, and it provides a positive attitude towards physics lessons (Algan 1999, Stack 1995).

Physics education is in a continual evolving together with the changing world conditions. Therefore, creation of new learning media in the continuously improving educational programs and determining of the students towards physics lessons and physical experiments in a selection of learning materials and methods are essential for effective learning of the lectures. Attitudes are related to coping with and management of the emotions occurring during learning process, and they play an important role in directing human behavior. Whether attitudes occurring as part of a system of values and beliefs are positive or

negative affects learning process in a direct manner and influences future lives of individuals (Seferoglu, 2004; Sunbul et al., 2004).

According to Hendrickson, attitudes are the best predictor for estimation of students' success (Hendrickson, 1997). Activities must be planned, organized and implemented so that students may develop more positive attitudes (Pintrich, 1996). Many attitude scales have been developed for the determination of students' attitudes towards Natural Sciences. Regarding these scales, Hewitt (1990), Oliver and Simpson (1988), House and Prison (1998), Geban et all. (1994), Kind et al. (2007) Pell and Jarvis (2001), Reid and Skrybina (2002), Selvi (1996), Bilgin et al. (2006), Nuhoglu (2004,2008), Bozdogan and Yalcin (2005) have developed attitude scales toward physics lessons, physics laboratories, and science lessons Budak (2001) has developed an attitude scale toward chemistry laboratory; Ekici (2002) has developed an attitude scale toward biology laboratory; and Simsek (2002), Kan and Akbas (2005) have developed an attitude scale toward chemistry lessons. Researchers mostly examined attitudes of primary and high school students or candidate teachers, or investigated to the relationship between students' attitude and their success.

The objective of this study is to investigate the attitude of high school students towards physics lessons and physical experiments. It has been observed that studies that focus on all grades of high school (9^{th}, 10^{th} and 11^{th}) at once, especially regarding physics lessons and physical experiments, are limited in our country. However, any research about relating to attitude toward physics lessons and physical experiments of students in the province centre of Kayseri have not been available.

Limitations of the Study

1. This study is limited to 295 students randomly selected from 9^{th}, 10^{th} and 11^{th} grades of 7 high schools in Kayseri in academic year 2009-2010.
2. Positive opinion scale of the students measured in this study is limited to responding of the students to the questions.

Assumptions of the Study

1. Sample of the research represents the population.
2. Opinion scales of the students show their level of positive opinions regarding physics lessons and physical experiments.

Method

In this study, we aimed to research students' attitudes towards physics lessons and experiments, carried out together with scanning model in the Kayseri province centre in academic year 2009-2010

Population and sample

Population of the study is the high school students in schools of the Ministry of National Education in the Kayseri province centre in academic year 2009-2010. It is very difficult to reach the entire population, sampling was made and the study was carried out on 295 students.

Data collection tool

Before deciding on the questionnaire to be used as a data collection tool, former studies were examined. The questionnaire developed by Barmby et al. (2005) to question attitudes towards physics lessons and physical experiments of the students was decided to be used. Data collection tool was made end of this study was to pre-trial form, and than expert opinion was taken to ensure the validity of the questionnaire. The questionnaire was applied to a group of students to determining its clarity and understandability, and necessary revisions were made. Pilot study of the questionnaire was made on 25 students. Reliability of the questionnaire was

checked at this stage. Reliability factor of the applied scale regarding the sampling area came out to be as *Cronbach's Alpha =0.73*.

The questionnaire consists of two sections. First section is composed of multiple-choice questions checking the demographical features of the students, gender, grade and age. Second section of the questionnaire is consisting 20 items in total, 12 items are about the students' attitude towards physics lessons and 8 items about the students' attitude towards physical experiments. The students participating in the survey were asked to mark their level of agreement for the given statement, which have five degrees. Before making statistical analyzes, it was checked whether questionnaires were fully answered by the students and it was observed that some questionnaires had been missed and filled randomly. After eliminating 23 such questionnaires, it was found out that there were 295 valid questionnaires. Therefore, analyzes were executed on the data of these 295 students.

Data analysis

Acquired data were analyzed by using Statistical Package for Social Sciences 16.0 (SPSS 16.0) program. In this analysis, primarily descriptive statistics (frequency, percentage, mean, standard deviation) was calculated and the distribution characteristics have been revealed. For each question in the survey, students' level of participations as [(1) strongly disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, (5) strongly agree] for the positive comments, and as [(1) strongly agree, (2) agree, (3) neither agree nor disagree, (4) disagree, (5) strongly disagree] for the negative comments. Therefore, maximum students' attitude scores are 100 points, minimum is 20 points. End of these ratings, level of meaningful differences has been tested as $p<0.05$ using by t-test and analysis of variance, and Tukey test was applied as post-hoc test when needed. t-test was used for point out whether there is a meaningful difference between averages of two variable characteristics, and also, single factor variance analysis (ANOVA) was used for point out whether there is a meaningful difference more than two variables.

Findings

Findings related to the characteristics of the students

Results of the some students' profiles of the high school students (9^{th}, 10^{th} and 11^{th} grades) in the Kayseri province centre are given in Table 1. Gender distribution of the surveyed students came out as 125 girls (42.4%) and 170 boys (57.6%). According to their grades, students were distributed as 192 students at 9^{th} grade (65.1%), 77 students at 10^{th} grade (26.1%) and 26 students at 11^{th} grade (8.8%). According to students' ages, students were distributed as 14 year-old 5 students (38.0%), 15 year-old 138 students (46.8%), 16 year-old 105 students (35.6%), 17 year-old 42 students (14.2%), 18 year-old 2 students (0.7%) and 19 year-old 3 students (1.0%). Accordingly, most of the students answering the questionnaire were from 9^{th} and 10^{th} grades and of age 15-16.

Attitude towards physics lessons of students

Spring semester of the 2009-2010 academic years, studying students that 295 people and randomly selected from seven different high schools of the Ministry of National Education in the Kayseri province centre, frequency and percentage values of the answers from survey questions of the attitudes towards physics courses are given in Table 2.

		Frequency (f)	Percentage (%)
Gender	Boy	170	57.6
	Girl	125	42.4
Grade	9th	192	65.1
	10th	77	26.1
	11th	26	8.8
Age	14	5	1.7
	15	138	46.8
	16	105	35.6
	17	42	14.2
	18	2	0.7
	19	3	1.0

Table 1.

Distribution of participating students according to different variables

As can be seen from table 2, students who participated to the survey and replied to questions of 1th, 2th, 3th, 9th, 10th and 12th positive attitudes items such as *"We learn interesting things in Physics lessons"* 12.5%, *"I look forward to physics lessons"* 28.5%, *"Physics lessons are exciting"* 23.0%, *"I get good marks from Physics lessons"* 30.8%, *"I easily learn Physics topics"* 23.4%, and *"I understand everything lectured in Physics lessons"* 26.4% in low rates reported opinions of *"Strongly Agree"* or *"Agree"*. On the other hand, students replied to questions of 6th, 8th and 11th negative attitude items such as *"Physics lessons are boring"* 53.2%, *"I only fail in physics lessons"* 67.2%, and *"I feel helpless when doing my Physics homework's"* 58.3% in somehow high rates reported opinion *"Strongly Agree"* or *"Agree"*.

Regarding attitudes items such as 4th, 5th and 7th, the students' opinions and percentages of *"Definitely Agree"* and *"Agree"* were as follows: *"I would like to have more physics lessons at school"* 42.0%, *"I like Physics lessons more than the others"* 44.0%, and *"Physics lessons are difficult"* 34.6%.

In addition, scores of attitude towards physics lessons giving up points from 1 to 5 according to the level of agreement were calculated for each question. As a result of this questionnaire with 12 attitude items that could be maximum 60 points, the average of student attitude scores was calculated as $\overline{X}$=35.27. In addition, the attitude scores of students in the lowest 12, highest was 48 points. When it is considered that in a scenario of entirely indecisive population the average score should be 36, it can be concluded from these results that students are in an almost negative attitude towards physics lessons, and they have a low rate of interest, expectation and success in physics lessons. All of the students, even if indecisive, the average score should be 36, these results show that students' have almost in negative attitude towards physics lessons, and also interest in physics classes, is understood to be low expectations and achievements

Attitude towards physical experiments of the students

In order to determine the participating students' attitude towards physical experiments, 8 attitude items were asked to the students. Frequency and percentage values of the replies given by the students for each attitude items are given in Table 3. As shown in Table 3, students who participated in the survey replied to attitude items of answered affirmative questions such as *"Physical experiments are exciting"* 20.3%, *"I like physics experiments because I don't know what will happen"* 19.3%, "Physics experiments are useful, because I can work with my friends" 16.6%, *"I like physics experiments, because I can decide what to do myself"* 28.5%, *"I would like to have more experiments in Physics lessons"* 12.6%, *"We learn physics lessons better when we do physics experiments"* 8.4%, and *"I look forward to doing experiments in Physics lessons"* 18.3% in low rates reported opinions of *"Definitely Agree"* or *"Agree"*. On the other hand, students replied to 8th attitude item reading as *"Physics experiments in the physics lessons are boring"* was replied opinion of *"Strongly Agree"* or *"Agree"* in range of 75.6% by the participating students.

An overall view of the answers of students' regarding attitude towards physical experiments, as shown in Table 3, most of the students think that physics experiments are *boring* and *not exciting*.

Students' attitude scores towards physics experiments were calculated in the same way of the attitude scores towards physics lessons. As a result of this questionnaire with 8 attitude items that could be maximum of 40 points, the average attitude scores towards physics experiments of student was calculated as $\overline{X}$=27.80. In addition, the attitude scores towards physics experiments of students in the lowest 8, highest was 42 points. When it is considered that in generally view to entirely indecisive students the average score attitude scores towards physics experiments should be 24, from the statistical results, it can be concluded that students have negative interest and attitude towards physics experiments, is understood to be low rate of interest, expectation and success in physics experiments.

Assessment of students' attitude towards physics lessons and physical experiments according to Different Variables

It was statistically analyzed whether students' total score in their attitude towards physics lessons and physical experiments varied according to the variables of gender, grade or age variables. In this analysis, independent t-test was used for the group with two variables (the relationship between attitude score and gender) and one-way variance analysis to determine differences among groups with more than two variables (the relationship between attitude score and grade and age).

Independent t-test was applied to the gender variable that has a binary group to show its influence on the students' attitude scores towards in the physics lessons and physics experiments. The results are given in Table 4.

	N	$\overline{X}$	**sd**	**df**
Girl	125	62,74	10,15	293
Boy	170	63,32	8,61	

Table 4. Students' average attitude scores according to gender and t-test results

It can be seen from Table 4, the average attitude scores towards physics lessons and physics experiments of students is below the desired level. Besides, although the attitude scores of male students were found slightly higher than average value, average attitude scores of the male and female students were close to each other. However, the difference is statistically insignificant (p=0.60). In other words, there are no differences between the scores of students according to gender.

One-way variance analysis (ANOVA) was used to determine the influence of grade and age variables having more than two groups on the attitude scores, and results were given in Table

From variation analysis results, it can be say that grade-level differences of students' have been affected to scores of attitudes toward physics lessons and physics experiments (p=0.00). From the statistical analysis, it was found out that students from 10^{th} grade had a more positive attitude in comparison with the other grades in this research.

When it was examined whether the age difference affected the students' attitude towards physics lessons and physical experiments, the meaningful differences in favor of 16 (p=0.00) were found between students of age 16 and 17. Meaningful difference between the attitudes scores among other grades have not found in this research.

Discussion, Results and Suggestions

According to Mbajiorgu and Reid (2006) and Reid (2006), attitudes have four issues that are important in physics. These are attitudes towards physics, attitudes towards physics subjects, attitude toward learning physics, and scientific (the methods) attitude. Attitude scale in this study is agreed with to attitudes towards physics, attitudes towards physics subjects, attitude toward learning physics.

Many attitudes scales have been developed for determination of students' attitudes towards Natural Sciences. Same of these have been developed by El-Gendy, (1984), Misiti et al. (1991), Geban et al. (1994), Selvi (1996), Boone (1997), Morrell and Lederman (1998), Francis ve Greer (1999), Pell and Jarvis (2001), Kan (2005)Bilgin et al. (2006), Budak (2001), Reid and Skryabina (2002), Yesilyurt (2004), Nuhoglu and Yalcin (2004), Sengoren et al. (2006), Unal and Ergin (2006), Kind, et al. (2007), Nuhoglu (2008), Azizoglu and Cetin (2009) and Kurnaz and Yigit (2010) for attitudes towards science lessons and science laboratories.

The Cronbach-Alpha reliability coefficient is changes between in rang of 0.65-0.98. For example, the Cronbach-Alpha reliability coefficient (0.73) calculated in this work is some higher than the reliability coefficient values 0.63 and 0.67 obtained by Unal and Ergin (2006) and Azizoglu and Cetin (2009) in respectively. But, the value of reliability coefficient (0.73) in this work some smaller than the values 0.79 and 0.83 obtained by Bozdogan and Yalcin (2005) and El-Gendy (1984) in respectively. It can be said that attitude scaled are similar in terms of reliability.

In this study, it was examined whether the attitudes of the students varied according to gender, grade and age. As a result of the analysis, the average attitude scores of student was calculated as = 63.07 with a minimum of 20 points and maximum of 81 points. Considering that the attitude towards physics lessons and physical experiments came out as slightly higher than 60 points indicating indecisive neutral attitudes (63.07), it was found that students' attitude towards physics lessons and physics experiments are below the desired level.

The average attitude score of the students regarding physics lessons was calculated as 35.27, which is below the indecision level of 36 points. Accordingly, students' attitude towards physics lessons is mostly indecisive and somewhat negative. Students' average attitude scores towards physics experiments were calculated as $\overline{X}$ =27.80 with a minimum of

8 points and maximum of 42 points. It was seen from the results, students have negative attitude towards physics experiments, and interest in physics experiments, in low rate from the expected level.

Furthermore, it was statistically analyzed whether students' total score in their attitude towards physics lessons and physical experiments varied according to gender, grade or age variables. In this analysis, independent t-test was used for the group with two variables (the relationship between attitude score and gender) and one-way variance analysis to determine differences among groups with more than two variables (the relationship between attitude score and grade and age). Meaningful differences have not observed between attitudes of boys and girls by using t-taste. But, it was seen from ANOVA analysis, grade-level differences of students' is affect on the attitudes scores toward physics lessons and physics experiments.

Similar results obtained by Yesilyurt (2004) and Sengoren et al. (2006). Yesilyurt (2004) was found no significant difference between student teachers' groups of attitudes towards physics laboratory. And also, meaningful difference was not observed between of boys and girls of high school students' for the attitudes towards optic course obtained by Sengoren et al.(2006). These results are in good agreement with the students' opinions obtained in this study. The following suggestions can be posed with the hope that students' interest and attitude towards physics lessons and physics laboratory in their education life may be constituted.

Physics lessons being held in the classroom on the sole theoretical basis is one of the factors that influence attitude of the students toward these lessons in a negative manner. Thus, physical topics consist abstract concepts should be lectured in the students' daily life, together with simulations, animations and other videos to keep the attention of the students alive. Learning by discovery is better than passive listening, so it should be shown how to associate physical concepts with their daily life of the students. Instead of increasing physics laboratory lessons' hours, hands-on-science experiments which may be executed with effective, attract attention with simple materials should be developed. Studio physics which is a method of teaching that provides an integrated learning environment with hands-on lab measurements coupled with active student problem-solving should be apply in the physics lessons. In order to make physics lessons more interesting, physics instructors should convince students that physics serves them. Physics instructors should spend more efforts to associate physics–technology–daily life. Physics instructors should like their profession and reflect this to others. Such manners of instructors will improve the attitude of students towards physics lessons and physical experiments. However, it should be research whether teachers' training, teaching methods, students' families and environmental factors on influence students' attitude towards physics lessons.

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