Mart 2016 Cilt:24 No:2 Kastamonu Eğitim Dergisi 585-602

Opinions of School Principals and Physics Teachers on Laboratory Practices and Use of Laboratory Practices Within The New Physics Curriculum[1]

Okul Müdürlerinin ve Fizik Öğretmenlerinin Laboratuvar Uygulamalarına ve Yeni Fizik Öğretim Programı İçerisindeki Laboratuvar Uygulamalarının Kullanımına Yönelik Görüşleri

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İlk Kayıt Tarihi: 02.10.2014 ***Yayına Kabul Tarihi: 08.07.2015***

Abstract

In this study, it is aimed to identify the opinions of the high school principals and physics teachers working at the same schools regarding laboratory practices and the use of these practices within new physics curriculum. The study was carried out in the fall semester of 2013-2014 with 20 high school principals and 30 physics teachers working in Anatolian High Schools in Ankara via qualitative research techniques. The data obtained from the semi-structured interviews carried out face to face and individually with the school principals and Physics teachers were analyzed by using descriptive statistics method and the study findings were obtained. As a result of the study, high school principals and teachers have been identified to think that laboratories should certainly be used within the education process and the education in laboratories has a positive effect on the students' achievement, better understanding of the subjects as well as their attention and approaching to the lessons. In accordance with the opinions received with respect to the use of laboratory applications in the new Physics curriculum, six (30%) of the principals and 22 (73,33%) of the teachers have been found to believe that the curriculum is not suitable for laboratory applications. It was found out that the laboratory practices in the new Physics curriculum were impractical due to the inadequate number of course hours for the applications and the nonconformity of the curriculum with the university placement exam.

***Keywords**: School principals, physics teachers, physics curriculum, physics laboratories, physics education.*

Özet

Bu araştırmada, laboratuvar uygulamaları üzerinde etkili olduğu düşünülen ve aynı okullarda görev yapan okul müdürlerinin ve fizik öğretmenlerinin, laboratuvar uygulamalarına

1. This study was presented as an oral presentation at the 1 st International Educational Research Congress-EJER Congress 2014.

ve yeni fizik öğretim programı içerisindeki laboratuvar uygulamalarının kullanımına yönelik görüşlerinin belirlenmesi amaçlanmıştır. Araştırma, 2013-2014 öğretim yılı güz döneminde Ankara'da bulunan Anadolu liselerinde görev yapmakta olan 20 lise okul müdürü ve 30 fizik öğretmeni ile nitel araştırma yöntemlerinden yararlanılarak gerçekleştirilmiştir. Okul müdürleri ve fizik öğretmenleri ile yüz yüze ve bireysel olarak gerçekleştirilen yarı yapılandırılmış görüşmelerden elde edilen veriler betimsel istatistik yöntemi kullanılarak çözümlenmiştir ve araştırmanın bulguları elde edilmiştir. Araştırmanın sonucunda, lise okul müdürlerinin ve öğretmenlerin laboratuvarların öğretim sürecinde kesinlikle kullanılması gerektiğini ve laboratuvarda yapılan öğretimin öğrencilerin başarılarına, konuları daha anlamlı öğrenmelerine ve derslere karşı ilgi ve tutumlarına olumlu etkisinin olduğunu düşündükleri belirlenmiştir. Yeni fizik öğretim programı içerisindeki laboratuvar uygulamalarının kullanımına yönelik alınan görüşler doğrultusunda ise, okul müdürlerinin altı (%30)'sının ve öğretmenlerin 22 (%73,33)'sinin öğretim programının laboratuvar uygulamalarına uygun olmadığını düşündükleri tespit edilmiştir. Yeni fizik öğretim programı içerisindeki laboratuvar uygulamalarının, ders saatlerinin uygulamalar için yetersiz olmasından ve öğretim programı ile üniversiteye giriş sınavının yine uyumlu olmamasından dolayı kullanılamadığı ortaya çıkmıştır.

***Anahtar Kelimeler**: Okul müdürleri, fizik öğretmenleri, fizik öğretim programı, fizik laboratuvarları, fizik eğitimi.*

1. Introduction

Today, advanced societies give importance to education as the most significant factor in improving the required skills in individuals according to the requirements of their ages. It is observed that the ability to think, knowledge and skills can be improved in individuals through an effective education (Güneş, Güneş, & Hoplan, 2012). Science, which is a part of the education, enables people to understand the nature and himself/herself in the nature as well as knowing about and interpreting the technological developments (Turgut et al., 1997). By means of science, the planned and programmed initial attainments, which are carried out at schools, the interest of students in experiment, observation, exploration and research can be improved (Akdeniz & Karamustafaoğlu, 2002). In laboratories that are an inseparable part of science and play an important role in school education, students learn through experiencing, proving, experimenting, critical and scientific thinking as well as interpreting (Lawson, 1995). Although, it is emphasized in the research studies that laboratory applications are effective in students' better understanding of abstract subjects, improving manual skills, increasing their approach and success in science, realizing how to reach scientific facts and improve problem solving and examining skills (Çepni et al., 1994; Hofstein & Lunetta, 1982), it is seen that the laboratory practices cannot be used because of inappropriate laboratory and school conditions, lack of equipment and inadequate laboratory knowledge of teachers (Alpaut, 1993; Ayas et al., 1994; Çepni & Azar, 1999; Bozkurt & Sarıkoç, 2008). It is reported in several research papers that, especially in Physics lessons, which constitute many abstractions and play an important role in science, using laboratory applications instead of traditional education methods could be more effective to ensure permanent, meaningful, visual, experimental and research-based learning of students (Sarı, 2013). By the use of laboratory applications in Physics education, the students are able to have a better knowledge of and make sense of a physical event during an experiment that is taught theoretically (Tereci & Karamustafaoğlu, 2013). The planning and application of the laboratory practices, which are a part of the education, are carried out by teachers. The continuity of education is also ensured by the teachers, students and the curricula. Teachers, who enable students to reach, organize, present and assess information as well as improving communication skills, form the most important element that ensures the achievement of curriculum goals (Bozkurt & Sarıkoç, 2008; Mitchener & Anderson, 1989). According to the literature, the objectives of the curricula were not carried out by the teachers as they desired due to inadequate course hours, extensive content of the program, difficulty of class management, lack of laboratory equipment and unsuitable physical conditions (Kimpston, 1985; Tobin, 1987; Gallagher, 2000). The relationship between school principals and teachers is another element that affects education and training. Principals and teachers stay in contact all the time; and principals ensure teachers to improve their motivation, performance and approach and to meet their expectations (Altunoğlu & Atav, 2005). As a result of the effective communication and agreement between principals and teachers, it is ensured that the required resources and environments in the field of education are provided, the factors leading improvements in student achievement are developed and the school education is strengthened (Morrison, 2007). In addition to these, it is seen that school principals play an important role in inspection, development, directing and assessment of the education process, leading to establish an effective learning environment, management of physical resources and relationships with the environment (Şişman, 2002; Tebliğler Dergisi, 2003, as cited in Canbazoğlu, Eroğlu, & Demirelli, 2010). When the studies carried out by receiving the opinions of school principals in the national and international literature are examined, it is usually seen that education and training are correlated with the practices of schools, competences, duties, skills, curriculums and leadership types (Hoy & Miskel, 1996; Van Voorhis & Sheldon, 2004). And in the national literature, it was found out that there is a study including the opinions of school principals regarding Physics laboratory applications (Ekici, Ekici, & Taşkın, 2002). In view of all these points, this study, which includes the opinions of the high school principals, who play an important role in every field of education and Physics teachers working at the same schools regarding laboratory practices as well as the use of these practices in the new physics curriculum which has been gradually applied since 2013-2014 academic year, is believed to have contributions to the Physics education.

2. Method

In this study, which was carried out to identify the opinions of the high school principals and physics teachers working at the same schools regarding laboratory practices and the use of these practices within the new physics curriculum, qualitative research methods are used. In accordance with the qualitative research method, an interactive process between the researchers and principals as well as the researchers and teachers was formed (Yıldırım & Şimşek, 2013). During the study, the researcher interprets the opinions of the teachers and principals in line with the responses to the questions directed to them, and completes the study by contributing to these opinions.

Study Group

The study was carried out in the fall semester of 2013-2014 academic year with the participation of 20 high school principals and 30 physics teachers working in Anatolian High Schools in Ankara. In this study, which was carried out via qualitative research technique, the participants were determined according to the criterion sampling method that is aimed for obtaining in-depth and rich data (Patton, 2002). The basic reason in the criterion sampling is the inspection of all conditions covering the determined criteria (Yıldırım & Şimşek, 2013). In the criterion sampling method used to select people that meet the set criteria, a study was carried out with the school principals and Physics teachers working in the same Anatolian high school, which had been determined as the criterion. Furthermore, demographical characteristics of school principals and physics teachers in the study group were analyzed. School principals had 15 to 34 years of professional experience, and the teachers had 13 to 45 years of experience.

Data Collection Tool

In the study, semi-structured interview forms prepared by the researchers to identify the opinions of the high school principals and physics teachers regarding the laboratory practices and the use of these practices within new physics curriculum were used as a data collection tool. While there are 9 open-ended questions in the interview form prepared to identify the opinions of the school principals, there are 10 open-ended questions in the form for the teachers. Within the scope of the pilot study three school principals and three Physics teachers were interviewed and it was determined also by the opinions of three experts of Physics education that the data collection tool is appropriate to reveal the opinions on laboratory practices and the use of laboratory practices in physical education program.

Carrying Out the Practice

In the study, semi-structured interviews were carried out with school principals and teachers. The interview technique provides data with different quality and depth considered to other methods, and it is a controlled and purposeful verbal way of communication that occurs between the researchers and the interviewed person or people (Cohen & Manion, 1994). The interviews carried out with school principals and Physics teachers aimed to reveal their thoughts, opinions and feelings within the framework of the independent answers they had given to the open-ended questions directed to them (Yıldırım & Şimşek, 2013). The semi-structured interviews carried out face to face and individually with the school principals and Physics teachers were 25-30 minutes long and recorded with a tape recorder. And then the recorded data were registered into computer files created for each principal and teacher.

Analysis of the Data

In the study descriptive statistical method was used to analyze the data obtained via data collection tool, summarize data and interpret the study results. In the descriptive statistical method, direct quotations were usually included to reflect the opinions of the interviewed person or people effectively and impressively (Yıldırım & Şimşek, 2013). In this study, the findings are also supported with the quotations from the statements of school principals and teachers with respect to their opinions. In the first phase of the descriptive analysis used to analyze the study data, the responses of the principals and teachers given to each question were read over and a framework for the data analysis was established by creating individual files for each question in an electronic environment. In order to organize and present the data under themes, the data in the files created for each question are categorized according to their similarities. Then, the categorized data were classified in itself in accordance with the required subjective. In order to ensure the reliability of the study prior to explaining, relating and interpreting the findings obtained in the study, data were categorized twice at different time periods. Opinions of two physics education expert with same experties were taken with respect to the compliance of the categories with the research problem. As a result of the received opinions and recommendations, some data were supported with quotations and the study findings took its final form

3. Findings

The findings obtained from the analysis of the responses of nine questions asked to the principals and ten questions directed to the Physics teachers, the aim of which were to identify the opinions of the high school principals and physics teachers regarding laboratory practices and the use of these practices in new physics curriculum, are presented in detail below.

Findings Regarding the Mutual Questions Directed to School Principals and Teachers

The first question asked to the principals and Physics teachers participated in the study was "What is the aim of laboratory practices according to you?" All principals and teachers participated in the study stated the aim of the laboratories as ensuring students to transform theoretical information they received into permanent information via performing and experiencing.

The second question directed to principals and Physics teachers was "Do you think the Physics laboratories in your school are used effectively? Please, explain." (Table 1).

Table 1. Opinions on the utilization of physics laboratories

Responses of School Principals and Teachers	Number and Percentage of Teachers (f,%)	Number and Percentage of School Principals (f,%)
Laboratories are used effectively.	6 (%20)	14 (%70)
Laboratories are not used effectively.	24 (%80)	6 (%30)

As displayed in Table 1, 14 (70%) of the school principals and six (20%) of the teachers stated that laboratories were used effectively, while six (30%) of the school principals and 24 (80%) of the teachers stated that they were not used effectively. Moreover, 24 (80%) of the teachers, who stated that the laboratories were not used effectively, indicated that they would like to use the laboratories effectively. The principals and teachers, who stated that laboratories were not used effectively, explained the reason of this with factors such as inadequate allocation of course hours, unsuitable physical conditions, lack or absence of experimental materials (Table 2).

Table 2. Teachers' opinions on the failure in using physics laboratories effectively

Responses of School Principals and Teachers	Number and Percentage of Teachers (f,%)	Number and Percentage of School Principals (f,%)
Inadequate Course Hours	19 (%63,33)	6 (%30)
Unsuitable physical conditions	14 (%46,66)	6 (%30)
Inadequate experiment materials	12 (%40)	5 (%25)
Necessity of an assistant teacher's support in the laboratory	10 (%33,33)	-
Noncompliance of the university exam system	5 (%16,66)	5 (%25)
To be unfavorable for students	3 (%10)	-
Inability of the teachers' field information on laboratory use	3 (%10)	-
Inadequate financial resources for improving laboratory conditions	-	4 (%20)
To be unfavorable for teachers	-	4 (%20)
Difficulties experienced by teachers in classroom management	-	2 (%10)

The third question asked to the participating principals and Physics teachers was "What are the effects of the education carried out using laboratories on the students?" (Table 3).

Table 3. Effects of teaching in laboratories on students

Responses of School Principals and Teachers	Number and Percentage of Teachers (f,%)	Number and Percentage of School Principals (f,%)
Improving achievement	24 (%80)	20 (%100)
Improving attention	24 (%80)	20 (%100)
Improving motivation	24 (%80)	20 (%100)
Concretizing concepts through overcoming conceptual failures	24 (%80)	20 (%100)
Ensuring permanent learning	24 (%80)	20 (%100)
Cultivating individuals who inquire, research and think	-	20 (%100)
Attributing cooperative working skills	24 (%80)	-

As displayed in Table 3, a majority of school principals and teachers stated that using laboratories in teaching had positive effects on students' achievement and attention, ensured that abstract concepts could be better learnt through overcoming conceptual failures, ensured permanent learning and enabled to cultivate individuals who could inquire, research and think as well as attributing students cooperative working skills. However, four (13,33%) teachers mentioned that laboratories were not useful in teaching; because, they were time consuming and simulation software had the same effect as the laboratories, while two (6,66%) of them stated that they were not able to express an opinion about the effects of laboratories; because they had never performed laboratory activities during their profession. Six (30%) school principals told that they were not able to state how laboratories could affect teaching, as laboratories were not used effectively at schools.

Another question directed to the principals and teachers participated in the study was "What do you think about conformity of the new Physics curriculum to laboratory practices?" (Table 4).

Table 4. Appropriateness of the new physics curriculum to laboratory activities

Responses of School Principals and Teachers	Number and Percentage of Teachers (f,%)	Number and Percentage of School Principals (f,%)
The new physics curriculum is appropriate for laboratory activities.	8 (%26,66)	8 (%40)
The new physics curriculum is not appropriate for laboratory activities.	22 (%73,33)	6 (%30)

The principals and teachers stated that the curriculum was not appropriate to laboratory practices because of reasons such as lack of course hours, inadequate time for practice, inapplicability of the university placement exam system to the program. Another finding obtained in the study was that six (30%) of the principals had no information on the new Physics curriculum. The principals and teachers stated their reasons as below in the semi-structured interviews (P: Principal; T: Teacher; #: Principal and teacher number, (*): Professional experience):

P5 (30 years): "The university placement exam system is not very suitable to carry out laboratory practices. The students, who enter university with multiple-choice exams, do not prefer laboratory practices considering them as a waste of time. In short, the students prefer mechanical learning."

P12 (33 years): "A new program has been prepared in order to catch up with the modern development. This curriculum is good but the given course hours are insufficient for practice. Therefore, I don't think that new Physics curriculum is appropriate for laboratory practices."

T9 (19 years): "I think it is not appropriate. I think, in the program there are such activities that can be demonstrated on the smart boards."

In accordance with the opinions of the principals and the teachers, it is thought that the class hours must be increased and the university placement examination system must be reorganized according to the curriculum in order to perform the laboratory practices in the new physics curriculum.

"Is there a need for the special training for using the laboratory in your school?" Please explain." This question was directed to the principals and the teachers as the last question (Table 5).

Table 5. Opinions on special training about laboratory activities

Responses of School Principals and Teachers	Number and Percentage of Teachers (f,%)	Number and Percentage of School Principals (f,%)
Special training about laboratory activities is required.	13 (%43,33)	18 (%90)
Special training about laboratory activities is not required.	17 (%56,66)	2 (%10)

As displayed in Table 5, 18 (90%) school principals required special training about laboratory activities, while 17 (56,66%) teachers mentioned that their graduate education was adequate for using laboratories. Furthermore, both teachers and school principals emphasized that teachers should participate in in-service training programs in cooperation with academicians at universities due to the improving technology and updated teaching programs.

Findings Regarding the Questions Directed to School Principals

As well as the mutual questions directed to the school principals and the teachers participating in the study, the question "What do you think about the suitability of your school's conditions with respect to the use of laboratory (in terms of location, equipment, material, supply etc.)?" was asked (Table 6).

Table 6. Appropriateness of school facilities to using laboratories

The Answers of the Principals		The Number and Percentage of the Principals f (%)
School facilities are appropriate for using laboratories.	Laboratory conditions are very well	14 (%70)
School facilities are not appropriate for using laboratories.	There are not enough experiment tools	6 (%30)
	Experiment tools are not competent with technological developments	6 (%30)
	Laboratory space is small.	6 (%30)
	Certain laboratories are used collectively	6 (%30)

14 (70%) school principals mentioned that laboratory conditions were appropriate for activities, while six (30%) of them said they were not appropriate. Principals of the schools, which did not have appropriate laboratory conditions, stated that there were certain problems such as lack of experiment tools, incompetence of laboratory tools to technological developments, small laboratory spaces and collective use of certain laboratories.

"Do you think that the laboratory practices are performed in such way that meets the objectives of the curriculum?" was another question that was directed to the principals (Table 7).

Table 7. Opinions about whether laboratory activities address the aims of teaching programs

The Answers of the Principals		The Number and Percentage of the Principals f (%)
Laboratory practices do not address the aims of teaching programs.	Lack of time	16 (%80)
	Incompatibility of the university placement test with the curriculum	16 (%80)
	Preferring to use simulation experiments with smart boards	16 (%80)
No comment	Not knowledgeable	4 (%20)

School principals and teachers reported that laboratory practices were not favored as they were not compatible with the university placement test and there was lack of time, and that therefore, laboratories are not used in a way to address the aims of the curriculum. Furthermore, they mentioned that teachers preferred to use the simulation experiments presented within the Fatih project. Four (20%) principals expressed that they did not have any opinions about this issue.

"What kind of an impact does your subject area of teaching have on your perspective to the physics laboratory?" was another question directed to the principals. 17 (85%) of the participating principals stated that the impact of their teaching field and administrative tasks were related to the physics laboratory, whereas three (15%)

of them stated that they performed their tasks about the physics laboratory as a principal. The principals stated the impact of the subject areas of teaching on the physics laboratory as follows:

P3 (39 years): "Everything that is indispensable for the students is significant for me. As the students of our school are from the science field mostly and my field is physics, I can say that I am more interested."

P13 (27 years): "I, as a principal, must be interested in everything in the school. I search, learn, question and do my best to perform the best."

In the interviews with the teachers, it was detected that the vast majority of the principals were interested in the physics laboratories due to their teaching fields and their being principals.

"To you, what should be done to increase the use of laboratory in your school?" was directed to the principals as the last question. The recommendations that were put forward by the principals at most for the use of the laboratory are: to encourage the teachers by paying them extra charges, hiring assistant teachers in the laboratory, improving the physical conditions of the laboratories and making the experiment appropriate for the new technologies (Table 8).

Table 8. The factors for increasing the use of laboratory

The Answers of the Principals		The Number and Percentage of the Principals f (%)
Improving physical conditions	Support from the Ministry of National Education for improving physical conditions	13 (65%)
	Support from the Ministry of National Education to ensure that laboratory tools are competent with modern technologies	
Providing teachers with additional opportunities	Encouraging the teachers with the extra charges	11 (55%)
	Having assistant teachers in the laboratory	11 (55%)
University placement system and curriculum	Making the examination system appropriate for the curriculum	8 (40%)

The principals made the following statements that supported their thoughts about increasing the use of laboratory (P: Principal, #: Number of the principal, (*): Professional experience):

P11 (33 years): "The teachers are exhausted as performers of the laboratory practices and they do not get same wages as their performances. The teachers should be encouraged to use laboratories and motivated by payments regarding the reports."

P17 (32 years): "The laboratories materials must be completed and the students must know and use the materials very well. The Ministry of Education must perform its duty and improve the laboratory conditions, establish the laboratories that are appropriate for the objectives, the new technologies and that are well-designed. The students should use the materials appropriate for their objectives and the principals must provide a more efficient teaching by controlling the students."

Findings Regarding the Questions Directed to the Teachers

“What are the roles of the students and teachers in the laboratory practices?” was directed to the physics teachers participated in the study (Table 9).

Table 9. Role of the teacher and the students in laboratory practices

The Answer of the Teachers		The Number and Percentage of the Teachers f (%)
Student-oriented	Students reach conclusions by using experiment tools by themselves.	26 (%86,66)
Teacher-oriented	Teachers perform the experiment by themselves.	4 (%13,33)

The teachers stated their opinions on the roles of the teachers and the students in the laboratory practices in the semi-structured interviews as follows: (T: Teacher, #: The number of the teacher, (*): Professional experience):

T5 (26 years): “The subjects that will be taken seriously by the students and will be thought as useful for them by the students must be performed by themselves. As there is lack of time, if the teacher acts as a guide, the application may be completed on time.”

T23 (20 years): “The teacher must perform the experiments, the student must observe the experiment in a passive position. Because the students think the laboratory as entertainments and do not perform the necessary things by themselves.”

The interviews performed with the teachers have shown that most of the teachers thought that the teachers must act as a guide to complete the application due to the lack of time in the laboratory whereas, due to the fact that the students were not aware of the objectives of the laboratory; some of the teachers thought the teachers had to perform the experiments as a demonstration, while the students remained in a passive position.

“According to you, in which subjects should the laboratory practices be performed?” was directed to the teachers participating in the study. The participating teachers stated that the teachers preferred to use the laboratory practices in electricity, heat and temperature and optical at most (Table 10). As a result of the interviews performed with the teachers, they were identified to believe the abovementioned subjects had to be used with the theoretical information due to the difficulties in learning and for realizing the meaningful learning.

Table 10. The topics in which the laboratory practices are performed

Topics	The Number and Percentage of the Teachers f (%)
Electrical	12 (40%)
Heat and temperature	10 (33,33%)
Optical	9 (30%)
Simple harmonic motion	8 (26,66%)
Waves	5 (16,66%)
Rotational Motion, Density, Capillarity, Expansion	3 (10%)

Another question that was directed to the teachers was "In which stage should the laboratory practices be used in the teaching process of a topic and is it necessary? If it is, why?" (Table 11).

Table 11. The place of laboratory practices within the process of teaching the topic

The Answer of the Teachers		The Number and Percentage of the Teachers f (%)
At the end of the topic	Concretizing the concepts	14 (%46,66)
	Reinforcing the concepts	14 (%46,66)
	After attaining the theoretical knowledge required	14 (%46,66)
During introduction to the topic	Enabling students to think about the concepts	10 (%33,33)
	Starting the topic with more competence	10 (%33,33)
At all stages of topic	Using at all stages of the lesson according to the topic	6 (%20)

14 (46,66%) teachers stated that laboratories should be used at the end of the topic in order to concretize the concepts and ensure reinforcement after the theoretical knowledge was attained and the topic is taught. 10 (33,33%) expressed that they should be used at the introduction phase in order to ensure that students think about the topic and become competent about the topic at the beginning. Six (20%) of them mentioned that they should be used at all stages of the lesson according to the topic. Teachers' opinions were as follows:

T1 (20 years): "First the student will look through and comprehend the subject and then theoretical knowledge will be given. Therefore, I use the experimental applications at the beginning of the lecture."

T20 (27 years): "The laboratory applications should be carried out at the end of the lesson, after lecturing, for the purpose of supporting the subject. Because first of all, a basis should be formed with theoretical knowledge for the students."

The Physics teachers' were asked "Would it be possible to benefit from the physics laboratory applications in relation to eliminate concept errors, lack of information and misconceptions?" 25 (83,33%) of teachers indicated that the concept errors, lack of information and misconceptions of students might be eliminated by means of laboratory applications, while six of 25 teachers stated that these might be eliminated also by benefitting from smart board usage, simulations and videos in the classroom instead of laboratory applications. As for five (16,66%) teachers, they could be eliminated with the theoretical information more effectively. The opinions of the teachers were as follows:

T7 (13 years): "The laboratory is a waste of time. We can do the same things with the simulations on the smart board and the videos."

T11 (18 years): "I think the attention of the students in the laboratory is not on the apparatus and they *do not pay attention to the things I say. Therefore, the concept errors, lack of information and misconceptions can be theoretically eliminated in the classroom more effectively."*

T12 (34 years): "The topics that the students learn by performing in the laboratory themselves are more persistent. At the same time, when the students perform practices in the laboratory, the existing concept errors, lack of information and misconceptions can be easily eliminated. For instance, the 12th grade students think that the current passing through the series circuit decreases. I took them to the laboratory, they performed the experiment by themselves and the concept errors were eliminated."

In accordance with the opinions of the teachers, it was identified that the laboratory was considered as a waste of time, the students in the laboratory were not focused on the experiment and the existing concept errors could be eliminated with the practice performed in the laboratory.

"What are the interest levels of the principals towards the laboratories? If it is low, how could this be increased?" was the last question that was directed to the physics teachers. 11 (36,66%) of the teachers stated that the principals were not interested in the laboratories and deal with the problems of the laboratories, whereas 19 (63,33%) expressed that the principals were interested in the laboratories; however, they were not able to achieve anything due to the problems such as lack of time in the curriculum and the lack of financial facilities necessary for improving the laboratory conditions.

4. Results, Conclusions and Recommendations

In the study that was performed for identifying the opinions of the principals and teachers serving in the same school about the laboratory practices and the laboratory utilization within the new physics curriculum, it has been revealed that the principals and the teachers believed that the objective of the laboratory practices was to turn the theoretical information of the students into the persistent knowledge by performing and experiencing. The similar findings were observed in the studies of Sarı (2013), Bozkurt and Sarıkoç (2008) and Akdeniz, Çepni and Azar (1999).

It was identified that the vast majority of the school principals, who participated in the study, thought that the physics laboratory was used effectively, whereas the physics teachers serving in the same schools thought that the laboratories were not used effectively. As Tanrıöğen (1998) stated, the principals and teachers must be in connection with each other for developing and strengthening the education and training. However, it could be said that there is a lack of communication between the school principals and teachers on the basis of the result obtained from the study (as cited in Koçak & Helvacı, 2011). Hence, considering the answers of the school principals and physics teachers serving in the same school and the fact that at least one physics teacher from each school was interviewed, the teachers and the principals gave the contradictory answers about the utilization of the laboratory. It was identified that the laboratories in the schools were not used effectively due to the inappropriate physical conditions of the schools, materials that are insufficient and inappropriate for the technological developments, the insufficient financial support for improving the laboratory conditions, the university placement exam that is inappropriate for the curriculum due to the multiple choice questions, the fact that teachers do not prefer the laboratory due to the lack of time and difficulty of class management, the insufficient field knowledge of the teachers as well as the need for an assistant teacher in the laboratory. It was observed that the study by Çepni et al. (1994) was also supportive of the conclusions of this study. In this study, in which the opinions of the principals about increasing the laboratory usage in the schools were taken, it was revealed that the factors that were among the reasons why the laboratories, which encouraged the students to make practices, developed their research abilities, proved their scientific opinions, could not be used (Sarı, 2013) must be eliminated and the support of the Ministry of Education was needed in this process.

It has been revealed that the teachers and school principals believed that the teaching performed with a laboratory use has positive effect on the success, interest, attitude of the student, eliminating the lack of concepts and better understanding of the abstract concepts, the permanent learning, raising individuals who inquire, search and think, and gaining the ability of cooperative work. In many studies performed on the contributions of the laboratory practices to the education, similar results have been obtained (Bates, 1978; Hofstein & Lunetta, 1982; Beasley, 1985). It has been identified with the opinions of the majority of the teachers that the concept error, lack of information and misconceptions could be eliminated by the laboratory practices (Hofstein & Lunetta, 1982). Another result obtained by the study was that some of the physics teachers thought that the laboratory practices had no positive effect on the students due to the facts that the teaching performed with the laboratory practices created waste of time, and that the simulation programs had the same function with the laboratory practices. However, the studies have shown that the teaching that was performed by using laboratory practices enabled the students to become more equipped in terms of knowledge and skills (Hodson, 1990; Singer, Hilton, & Schweingruber, 2005). Another striking finding in the study was that some of the teachers had never carried out laboratory practices in their professional lives. In some studies, similar findings were found out because of reasons such as inadequacy of laboratories and teachers' unwillingness to perform experiments (Güneş, Şener, Germi, & Can, 2013). When the obtained data were examined, underutilization of laboratories may have been originated from teachers who considered laboratories as a waste of time and students who were unenthusiastic as well as the inappropriate physical conditions of school and lack of financial resources for laboratories.

Another result obtained from the study was that the principals and teachers should be taking in-service education seminars or special trainings in cooperation with faculty members for laboratory use in accordance with the developing technology and updated curriculum. Also, in the studies carried out by Özmen and Ayas (2001) it was found out that the teachers had insufficient information on the purpose and use of laboratories and needed training regarding this insufficiency.

The importance of learning, in which students play an active role, can be emphasized with the quote "I hear and I forget. I see and I remember. I do and I understand." (Armstrong, 1973). And it was also stated by the Physics teachers in the study that students should be more active in laboratory practices. In the study carried out by Güneş, Güneş and Hoplan (2012), it was determined that students learned more meaningfully with experiments carried out by themselves, and this result was similar to the findings of this study.

It was found out that the Physics teachers considered the laboratory practices were especially effective and should be used in the subjects such as electric, heat and temperature, optic, basic harmonic motion, waves, rotary motion, density, capillarity and expansion. Teachers, who stated that laboratory practices should be used in teaching subjects, responded that laboratory practices could be used in the introduction, and if needed in every phase of the lesson, to objectify and strengthen the concepts, and after gaining the necessary theoretical information and completing the teaching of the subject to make the students think on and have control over the subjects from the beginning.

As a result of the opinions obtained from the Physics teachers and school principals regarding the conformity of the new Physics curriculum to laboratory practices, the principals and teachers were determined to believe that the curriculum was not appropriate to laboratory practices because of reasons such as lack of course hours, inadequate time for practice, inapplicability of the university placement exam system to the program. In line with the teachers' opinions, it could also be said that the problems such as lack of course hours, and inapplicability of the university exam to laboratory practices still continued in the new Physics curriculum. It should be noted that many studies emphasized the course hours should be increased in order to carry out laboratory practices (Altunoğlu & Atav, 2005; Tobin, 1987). These problems were considered to be originating from incomprehensive assessment of the developed or updated programs, failing to solve the deficiencies determined in the previous program or failing to take measures for the deficiencies (Ünal, Çoştu, & Karataş, 2004). In addition to these problems, it was revealed through the opinions of the principals that teachers and students did not prefer to use laboratories and teachers would rather show experiments on smart boards which were used within the scope of the Fatih project, and as a result the laboratory practices were not carried out to fulfill the objectives of the curriculum.

In this study, which investigated the effects of the principals on the approaches of the teaching domains' to Physics laboratories, it was supported by the research carried out by Koçak and Helvacı (2011) that the principals thought they fulfilled their managerial duties and formed an ideal behavior model as a school principal by correlating their teaching domain with Physics laboratories, assuming they were interested in laboratories because of their administrative duties. Although the teachers stated that the principals were interested in laboratories, the local press indicated that the laboratories in Turkey were not used appropriately with respect to their objective and laboratories were transformed into classes by principals because of inadequacy of teaching spaces (Ministry of Education [MEB], 2013). Today, school principals' effects on laboratories have been published widely in the local press. As a result of the study, the principals were identified to think that they could not do anything about these problems which were beyond their areas of responsibility because of inadequate course hours in the curriculum and lack of financial resources required for improving laboratory conditions. The reason of the financial inadequacy was that the article of "Enabling the education environments such as classroom, gym, library, laboratory and workshop to public access and purchasing goods and services to meet the requirements of the school", which has been implemented since 2012, is among the duties of the parent teacher associations (Küçük & Polat, 2013). As a result of this responsibility assigned to schools, schools have been observed to be unable to improve their conditions. According to the obtained results, it is recommended that this responsibility assigned to the schools should be rearranged, and it is believed that a study to solve the problems regarding laboratories carried out by principals, teachers and representatives of the Ministry of National Education would have great contributions to the field of education.

5. References

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