Investigation of Science and Technology Course Teachers' Perspectives towards Laboratories and Their Use Situations

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Abstract: In this research, Science and Technology teachers' use of laboratories, which have a very important place in their lessons, and their thoughts on this subject are examined. The fact that curricula and contemporary teaching approaches require frequent inclusion of activities, especially in science and technology courses, necessitates that teachers who will implement them and guide students must first understand the activities themselves, know them at the application level, and interpret the results obtained. Since the implementation of the activities in the laboratory environment ensures the realization of effective learning, science and technology lessons should be held in the laboratory environment. For this reason, the classroom size in schools should be reduced and the laboratory environment should be restructured according to the classroom sizes. Although Science and Technology teachers think that laboratories are useful in many ways when it comes to experimenting, it has been determined that classrooms are preferred more and the majority of teachers need in-service training in laboratory use. As a result of the research, it was determined that the most undesirable situations that teachers encountered in laboratory applications were the lack of experimental materials and crowded classroom sizes. In addition, it has been determined that teachers are aware of the importance of laboratory applications within the scope of science and technology course and if they do laboratory applications, they will provide more benefits in terms of teaching.

Key Words: Science and Technology Lesson, Laboratory Applications, Teacher Opinions

Fen ve Teknoloji Dersi Öğretmenlerinin Laboratuvarlara Karşı Bakış Açıları ve Kullanım Durumlarının İncelenmesi

Özet: Bu araştırmada, Fen ve Teknoloji dersi öğretmenlerinin, derslerinde oldukça önemli bir yere sahip olan laboratuvarların kullanımı ve bu konudaki düşünceleri incelenmektedir. Öğretim programlarının ve çağdaş öğretim yaklaşımlarının özellikle fen ve teknoloji derslerinde etkinliklere sıkça yer verilmesini istemesi, bunları uygulatacak ve öğrencilere rehberlik yapacak öğretmenlerin etkinlikleri önce kendilerinin anlamalarını, uygulama seviyesinde bilmelerini ve elde edilen sonuçları yorumlayabilmelerini zorunlu kılmaktadır. Etkinliklerin laboratuvar ortamında uygulanması etkili öğrenmenin gerçekleşmesini sağladığından fen ve teknoloji dersleri laboratuvar ortamında yapılmalıdır. Bu nedenle okullardaki sınıf mevcutları azaltılarak laboratuvar ortamı sınıf mevcutlarına göre yeniden yapılandırılmalıdır. Fen ve Teknoloji öğretmenleri tarafından deney yapma konusunda laboratuvarların birçok yönden faydalı olduğu düşünmesine rağmen dersliklerin daha fazla tercih edildiği, laboratuvar kullanımında öğretmenlerin büyük çoğunluğunun hizmet içi eğitime ihtiyaç duydukları belirlenmiştir. Araştırma sonucunda, öğretmenlerin laboratuvar uygulamalarında en çok karşılaştığı istenmeyen durumun deney malzemelerinin eksikliği ve sınıf mevcudunun kalabalık olması olarak saptanmıştır. Ayrıca öğretmenlerin fen ve teknoloji dersi kapsamında laboratuvar uygulamalarının öneminin farkında oldukları ve laboratuvar uygulamaları yapmaları durumunda öğretim bakımından daha fazla faydalar sağlayacakları belirlenmiştir.

Anahtar Kelimeler: Fen ve Teknoloji Dersi, Laboratuvar Uygulamaları, Öğretmen Görüşleri

1. INTRODUCTION

Science has an undeniable place and importance in the development of science. Because scientific thinking and the ability to apply scientific thought form the basis of science. For this reason, all countries attach great importance to the development of science education in order to sustain their existence, prove themselves in the field of science and technology, and achieve development in every field (Ayas, 1995; Ünal, 2003). This importance given to science education stems from the fact that science exists in every aspect of life.

In our developing and changing world, it is seen that the importance of science is adopted more and more by countries, and the investments made in this field are increasing day by day. Health, agriculture, environment, food technologies, space, energy needs, etc. the subjects are among the basic fields of science, and the importance of these fields is emphasized almost every day by all circles. The fact that science, which is so important, is a field that is interested, loved and preferred by students in the future, goes through a good science education where innovations are blended (Dönel Akgül et al., 2018).

Science can be defined as efforts to examine nature and natural events and to predict events that have not yet been observed (Kaptan, 1999; Yazıcı & Kurt, 2018). Science teaching enables students to realize

knowledge about a field, use scientific processes, cope with problems, transfer scientific knowledge to their daily lives, acquire research skills and use high-level mental skills (Korkmaz, 2000; Yazıcı & Kurt, 2018).

Science and Technology course includes both theoretical and practical dimensions; it also allows existing knowledge to be integrated into technology, used in a laboratory environment and associated with daily life. In this context, laboratory courses enable the concretization of many abstract concepts in the content of science. Increasing the number of abstract concepts negatively affects students' concept learning, the relationships they will establish between concepts, and the meaningful connections they will form between subjects. For this reason, the level of understanding of abstract concepts should be increased by supporting them with concrete examples and materials from daily life, and the basic concepts in the course content should be examined in depth and concept learning should be achieved (Azar, 2001). Laboratory courses have a very important function in order to concretize concepts and establish relationships with daily life (Yıldız et al., 2006; Akkuş & Kadayıfçı, 2007).

Ayas (1995) states that science is of great importance in the development of countries and therefore different approaches are tried in the development and implementation of science curriculum. In this context, in Turkey, the Primary School Science and Technology Course Curriculum has formed the basic understanding of the Science and Technology Course Curriculum integrated with the constructivist approach (Ministry of National Education [MEB], 2005). Then, the Science Curriculum, which was accepted in 2013 and implemented gradually, was put into practice. The vision of the 2013 Science Curriculum is defined as "raising all students as science literate individuals". Compared to the previous program, the reduction of gains in the field of knowledge learning enabled other learning areas to gain emphasis (Anılan et al., 2020). The 2018 science curriculum, which was prepared as a draft in 2017 and shaped with minor revisions in 2018, was created. Thus, it is aimed for teachers to guide students within the scope of the integration of science, technology, engineering and mathematics (STEM) and for students to reach the capacity of high-level thinking, product development, invention and innovation. Engineering and design skills were added to science, and creative thinking and entrepreneurship skills were brought to the fore in science (MEB, 2017).

One of the most important goals of science education is to raise scientifically literate individuals. Individuals who grow up as scientifically literate use scientific methods and techniques while proposing concrete and rational solutions to the problems they encounter in daily life. They can access information faster, produce new information, and use contemporary technologies effectively and efficiently (Aydoğdu & Pekbay, 2016). Since science subjects are mostly abstract and complex, providing concrete experiences in laboratories to help students understand them is one of the main purposes of using laboratories in science teaching (Aydoğdu & Pekbay, 2016; Morgil et al., 2009).

2. THE PLACE OF LABORATORIES IN SCIENCE AND TECHNOLOGY COURSES

The most important feature that distinguishes science from other sciences is; primarily by giving importance to experiment, observation and discovery, it provides students with the opportunity to ask questions, to develop their research skills, to form hypotheses and to interpret the results (Balagun & Odubunni, 1991). The fact that science attaches importance to observation and experimentation points to the laboratory method (Donelly, 1998). According to Lawson (1995), one of the most effective methods used in science teaching is the laboratory method. Ekici (2009) emphasizes that laboratories are a learning and teaching environment that provides opportunities for students to gain many skills such as gaining first-hand experience about science, understanding the research-based nature of science, and providing social environments by working together.

It is a science teaching approach that aims to research and question students that emerged with the constructivist theory in today's education system. In this approach, the teacher is the guide and the students are active and in the center; at the same time, they have become individuals who learn by doing and experiencing. In addition, the importance of laboratories in science courses has increased even more (Kaymak & Karademir, 2019).

Laboratories are where students have the opportunity to practically apply theoretical knowledge through observations and experiments; accordingly, it is an effective method in which they gain new information (Ergün & Özdaş, 2000). The basic philosophy of laboratory teaching is to test events and observe the results. Laboratory science teaching offers individuals the opportunity to ask questions, identify problems, and seek solutions by collaborating with those around them. Moreover, it

provides reasoning, critical thinking skills, understanding science and teaching students the ways of producing knowledge (Akdeniz et al., 1998). According to Baran and Doğan (2004), laboratory courses are very effective in helping students structure science-related knowledge, gain problem-solving skills and work collaboratively. As seen in the existing literature, it is seen that the laboratory course has many positive contributions to the learning-teaching process. Students learn science and scientific concepts easily when they actively participate in the events around them. In this context, laboratory courses are very important as they offer students the opportunity to experience the events one-to-one (Önen & Çömek, 2011).

In science teaching, laboratories are defined as environments where scientific applications are made in the form of demonstrations or experiments using tools and equipment suitable for their purpose, or environments where a subject or concept is taught through demonstration (Çepni, 2015; Kaymak & Karademir, 2019). When we look at science and technology courses, it is seen that laboratory applications are an indispensable part of science and constitute the building blocks of science (Kaymak & Karademir, 2019). In addition, it is emphasized that more frequent laboratory activities increase the success of students in science lessons (Hofstein & Lunetta, 1982).

Activities carried out in laboratories using specific tools, equipment and materials range from simple demonstration experiments to complex science research or experiments. While these activities are carried out, besides the tools, equipment and materials suitable for the class level and purely educational purposes, the tools used in daily life are also used. While laboratory applications were carried out in previous years to prove the accuracy of the scientific information learned, in recent years the laboratory has been accepted as environments where information is discovered and research-based learning takes place (Hofstein & Lunetta, 1982).

Experiments are divided into three types according to the way they are carried out: demonstration, group and individual experiments. Demonstration experiments are an effective method that is generally used in places where laboratory equipment is limited (in village schools, etc.), in dangerous experiments that are not suitable for students to do, and in applications that require professional skills. Individual experiments are experiments that students do on their own. In such experimental studies, students have the opportunity to make decisions and practice on their own. During this process, the student is provided with the necessary tools and equipment. In this way, students develop psychomotor behaviour, interpret what they see, solve problems, gain scientific process skills, etc. they can realize gains. Group experiments are experiments that several students do together. These experiments, which students carry out in solidarity with each other, contribute to students' effective learning in the science teaching process, although not as much as individual experiments (Çepni et al., 2005; Demir et al., 2011).

Laboratory studies in science lessons make the subject easier to understand, and also give students experience in planning the experiment and using their own knowledge. This method affects reasoning, critical thinking, understanding science and teaches students the ways of producing knowledge (Akdeniz et al., 1998; Hofstein & Lunetta, 2004). During teaching with the laboratory method, students make observations and collect detailed information. Therefore, this method also increases their interest in science lessons (Koray et al., 2007). When the success of the students who conducted the experiment themselves was compared with the success of the students in classes taught by demonstration and explanation method, it was determined that the success of the students who experimented by doing was higher (Killermann, 1998).

It is a known fact that laboratory applications are very important in terms of students turning the knowledge they have acquired into products by using their curiosity and creativity, or in putting theoretical knowledge into practice. In this context, in order to achieve these goals effectively and safely, it is necessary to take the necessary safety precautions in the laboratory and know the laboratory usage technique (Aydoğdu & Şener, 2016). For these reasons, laboratory studies should be carried out under the control of teachers.

3. SCIENCE AND TECHNOLOGY TEACHERS' USE OF LABORATORIES AND EXPERIMENTING SITUATIONS

No matter how well the curricula are prepared, they are meaningless if they are not implemented in the educational processes. The implementers of curriculum in educational environments are undoubtedly teachers (Tekbıyık & Akdeniz, 2008). Therefore, the teacher's quality and personality have an important role in the teaching process. The teacher is the person who directs the teaching and influences the attitudes and behaviours of the students. It is an important element that enables

learning in the classroom and outside of school (Sönmez, 2008). In the constructivist learning approach, the main task of teachers is to provide students with the skills of accessing and using information, rather than transferring existing knowledge. The most important source of differences in achievement and skill levels between classes in the same school and students in the same class is the teacher (OECD, 2009; Şimşek et al., 2012).

Laboratory applications are one of the most important elements of the science course. It is unthinkable that a science course can be effective without laboratory applications. Due to its nature, science course is a course that can be taught both in the classroom, in the laboratory environment and outside the school (Kılıç & Aydın, 2018). Science teachers are seen as the key element in achieving the desired goals of science experiments. In many classrooms, the teacher is responsible for issues such as pre-experiment planning, starting and continuing the experiment, managing groups, ensuring discussions within and between groups, and ensuring security (Kılıç & Aydın, 2018¸Tamir, 1991; Tobin & Gallagher, 1987).

The ability of students to acquire the necessary skills depends on the use of effective methods and appropriate materials in the teaching process. In this process, the main task falls on the teacher (Şimşek et al., 2012). Teachers should ensure that their students learn by comprehending rather than having them memorize existing information, develop their problem-solving skills in the face of new situations, and teach them to use scientific methods and processes. In the new program, the teacher's duty is defined as showing students the ways of learning and guiding them in this process (MEBTTKB, 2009; Şimşek et al., 2012).

According to a research conducted by Karaca, Uluçınar and Cansaran (2006), the majority of teachers think that science lessons should generally be taught through experiments; they stated that this situation was more preferred by the students. Erdoğan (2007) evaluated the New Primary School Science and Technology Course Curriculum based on expert, teacher and student opinions. As a result, it was revealed that the teachers could not implement the program at the desired level, citing reasons such as the teaching material, the time allocated for teaching, and the inadequacy of the in-service training programs.

When the literature on the subject is examined, it is seen that many studies have been conducted on teachers' opinions to identify the difficulties encountered in teaching science courses or in the laboratory (Erdemir, 2007; Geçer & Özel, 2012; Gökyer & Doğan, 2016; Karaca et al., 2006; Tuncel & Fidan, 2018; Türkoğlu & Dağ, 2018; Üstün & Demir, 2015).

Factors such as laboratories not being equipped in accordance with the technology of the current era, not being able to meet the student potential in schools, materials being old, missing or non-existent, teachers having concerns about not being able to replace broken materials, experiencing electricity and water shortages in the laboratory, hinder the practical teaching of Science and Technology courses can be considered as the biggest obstacles. For this reason, Science and Technology courses are mostly taught in classroom environments in primary schools in our country (Demir et al., 2011; Güzel, 2002). It has been determined that the majority of teachers who do not give the necessary importance to laboratory studies in their courses are teachers who did not acquire or were not taught laboratory habits at the university they graduated from and who do not have laboratory facilities in their schools (Şahin, 2001).

In the study conducted by Böyük, Demir and Erol (2010), it was concluded that teachers knew the importance of laboratories in science teaching, but they also considered themselves inadequate and partially sufficient in knowing and using the equipment in laboratories. Similarly, studies have shown that teachers do not include laboratory practices enough or at all and that teachers feel inadequate about laboratory practices (Kılıç et al., 2015; Şeker et al., 2006).

In science education, teachers' beliefs and thoughts about science, as well as their competence (Ültay et al., 2020), are effective in decisions regarding the activities to be carried out in the teaching environment (Levitt, 2001). While most of the experiments and activities to be done at primary and secondary school level should be done in the laboratory, the activities that should be done in the laboratory cannot be carried out due to many different reasons such as the students do not know the tools and equipment in the laboratory, they do not know the purpose of use of these tools, the teachers do not allow the use of the relevant activities and experimental materials (Başdaş et al., 2006).

Although it is so effective in concretizing abstract concepts and ensuring the development of students in many areas, it is not easy enough to apply the laboratory method. It has been determined by many researchers that the teachers' beliefs and behaviours, as well as variables related to the

laboratory environment and the student, have a significant impact on the efficiency of laboratory applications (Cansaran et al., 2004; Hofstein & Lunetta, 2004; Kocakülah & Savaş, 2011; Palmer, 2006). Demirci (1993) explained that the best success in science education will be achieved through learning based on experimental methods, but this will only be achieved with teachers who are well-trained in this field.

Research shows that experiments in the science and technology curriculum cannot be carried out properly in many schools; it shows that the experiments that can be done are generally done by teachers in the form of demonstration experiments (Çallıca et al., 2001). It shows that teachers do not know what purpose different types of experiments serve, and teachers who include various types of experiments in their lessons do not examine whether these experiments are suitable for their purposes. In addition, Şeker, Yalçın and Yurdanur-Altunay (2006) determined in their study that teachers felt inadequate about laboratory applications and that them rarely or did not include laboratory applications for various reasons. When teachers were asked how many hours they spent on laboratory work in a week, it was revealed that the majority did not allocate time for experimental activities (Ekici et al., 2002). In the findings of the same study, it was seen that teachers put forward reasons such as crowded classes, supply of broken or damaged materials, lack of classrooms, lack of time and lack of printed resources as reasons for not conducting experiments (Ekici et al., 2002; Kocakülah & Savaş, 2011).

Science teachers stated that they had difficulties in designing experiments due to lack of materials, and that they could not teach science lessons by supporting them with experiments due to the use of laboratories, crowded classrooms and inadequate laboratory environments (Bostan Sarıoğlan et al., 2020; Kocakülah & Savaş, 2011; Soğukpınar & Gündoğdu, 2020). In this direction, there are studies in the literature stating that the science course cannot be supported by experiments due to many disadvantages arising from the lack of physical environments (Akıncı et al, 2015; Bostan Sarıoğlan et al., 2020). With the increase in students' attitudes and interest in the lesson in laboratory applications, the advantages of permanent learning and the development of cognitive, sensory and psychomotor skills should not be ignored (Bostan Sarıoğlan et al., 2020; Yazıcı & Kurt, 2018).

The knowledge, skills and attitudes that are aimed to be acquired by students through laboratory studies are directly proportional to the knowledge, skills and attitudes that teachers have. Research on this subject has emphasized that laboratory studies are necessary in science teaching, but they are not fulfilled sufficiently (Alpagut, 1984; Güldal, 1991; Kaya & Böyük, 2011). In the studies conducted, teachers stated that the factors that prevent teachers from using laboratories are not having sufficient knowledge about laboratory use and difficulty in controlling the laboratory environment (Kaya & Böyük, 2011; Yalın, 2001). The teachers' views on experimenting and using a laboratory are presented in Table 1.

When Table 1 is examined, the majority of the Science and Technology course teachers stated that they rarely included experiments in their lessons and they mostly did it in the classroom. According to the distributions obtained; it is seen that there are more teachers who rarely include individual, group and demonstration experiments in their lessons. In addition, it has been determined that the rate of teachers who never use these experiments is too high to be ignored (Demir et al., 2011).

The most important task falls to the teachers in the process of efficient use of laboratories, which are of great importance in science teaching, to provide students with the ability to use laboratories, to conduct experiments using simple tools and laboratory environments outside the classroom. In this context, during undergraduate education, prospective teachers should be informed about many issues such as how to teach scientific process skills and how to involve students in experiments with simple tools and equipment before starting their teaching profession (Yu & Bethel, 1991).

Table 1: Experimenting and Laboratory Usage Status of Science and Technology Teachers Participating in the Research (Demir et al., 2011).

		Frequency (f)	Percentage Value (%)
a- Frequency of Including Experiments in Science and Technology Lessons	None	0	0.0
	Occasionally	62	63.9
	Generally	30	30.9
	In all application courses	4	4.1

b- Place where the experiments are carried out	In the classroom	49	50.5
	In the lab	43	44.3
	In both	4	4.1
c- Frequency of Conducting Individual Experiments	Never	13	13.4
	Rarely	71	73.2
	In all application courses	12	12.4
d- Frequency of Group Experiments	Never	16	16.5
	Rarely	65	67.0
	In all application courses	15	15.5
e- Demonstration Experiment Frequency	Never	13	13.4
	Rarely	58	59.8
	In all application courses	25	25.8

Teachers' opinions were asked about the laboratory conditions in the schools where they work and the results are given in Table 2 (Uluçınar et al., 2004).

Table 2: Teachers' Opinions About Laboratory Conditions in the Schools Where They Work (Uluçınar et al., 2004).

Number	Article	Absolutely I agree		I agree		No idea		I do not agree		I absolutely disagree	
		f	%	f	%	f	%	f	%	f	%
1	There is a laboratory for experimenting.	42	59.2	21	29.6	0	0	7	9.9	10	1.4
2	A ventilation system is sufficient in the laboratory.	10	14.1	26	36.6	2	2.8	23	32.4	10	14.1
3	There are first aid supplies in the laboratory.	6	8.5	12	16.9	7	9.9	21	29.6	25	35.2
4	There is a fire extinguisher in the laboratory.	13	18.3	15	21.1	8	11.3	17	23.9	18	25.4
5	There is enough material to experiment with.	20	28.2	23	32.4	5	7.0	20	28.2	3	4.2
6	The electrical equipment of the laboratory is checked by the authorized person at the beginning of each academic year.	15	21.1	13	18.3	23	32.4	13	18.3	7	9.9
7	Cabinets containing hazardous materials are locked.	26	36.6	23	32.4	1	1.4	12	16.9	9	12.7
8	Cabinets where chemicals are stored are securely fixed.	23	32.4	20	28.2	4	5.6	19	26.8	5	7.0
9	The cabinets where the experimental materials were stored were securely fixed.	25	35.2	17	23.9	1	1.4	23	32.4	5	7.0

In the study conducted by Uluçınar et al. (2004), 88.8% of the teachers stated that there was a laboratory in the school for experimenting. 69% of the teachers in the sample stated that dangerous substances are in locked cabinets, 60.6% of them stated that chemical substances and 59.1% of experiment materials are safely stored in fixed cabinets. Teachers who thought that the ventilation system of the laboratory was sufficient and had no idea about the control of electrical equipment constituted half of the sample, while 64.8% did not agree on the presence of first aid materials and 49.3% did not agree on the presence of a fire extinguisher.

Students think that it is more accurate and effective to do the experiments themselves. Because if students do the experiments themselves, learning becomes more permanent; if the teacher does it, the student misses some points. It is seen that science lessons gain meaning through applications, and that experimental applications have many important aspects such as retention in an interesting and entertaining way, focusing on

lessons, consolidating theoretical knowledge, and being able to relate them to daily life. However, in many studies conducted in our country, it is seen that teachers teach with traditional methods and do not use student-centered, active teaching methods much (Doğru, 2000; Yıldırım & Demir, 2001; Morgil et al., 2002; Özdemir, 2006).

4. CONCLUSIONS AND DISCUSSION

In many studies in the literature (Akıncı et al., 2015; Demir et al., 2011; Güneş et al., 2013; Şimşek et al., 2012; Soğukpınar & Gündoğdu, 2020; Tekbıyık & Akdeniz, 2008), the inadequacies of the physical environment of the science laboratory and overlapping results are observed regarding the lack of experimental materials. It is seen that the majority of teachers stated that experiments and activities are carried out in the laboratory occasionally or once or twice a month. It has been determined that teachers mostly conduct experiments and activities in classrooms, not in the laboratory. This situation is thought to be caused by the crowded classrooms, the lack of materials in the laboratory, and the unsuitable physical conditions of the laboratory (Soğukpınar & Gündoğdu, 2020).

In the research conducted by Soğukpınar and Gündoğdu (2020), half of the teachers stated that there was noise in the classroom and the class size was crowded. It can be said that the reason for the excessive noise in the lessons is the high number of students in the classrooms, as well as the lack of interest of the students in the subject. The findings of studies conducted in the literature on the subject also support this conclusion. For example, Türnüklü and Galton (2001) stated in their study that students made noise in the classroom and talked without permission. Çetin (2013) similarly found that students spoke without permission.

Teachers have positive opinions about experiments carried out with simple tools and equipment. According to some of the studies supporting this view; As a result of the research conducted by Collison (1993), it was seen that science teachers had positive attitudes towards science teaching with simple tools and equipment. Çeken's (2010) study shows parallelism with the finding that the interest in science lessons has increased.

It can be said that more fun and interesting learning environments are created with the use of experimental applications in science teaching. The key element in achieving the purpose of science experiments is seen as the science teacher (Ayas et al., 1994). However, one of the most important results from the research is that many science teachers do not use laboratories, and teachers in schools that do not have laboratories do not include experiments in the classroom and in out-of-school environments.

It can be said that the way teachers use teaching materials directly and significantly affects their learning goals (Shymansky & Penick, 1981). Teaching students to understand science concepts, many of which are abstract, without a laboratory causes problems (Çepni et al., 1995). Considering the importance of laboratory courses in science teaching, it is seen that it is extremely important for teachers to use experiments with simple tools. For this reason, teacher candidates should be given the ability to use laboratories during the undergraduate education process. Because science is a course that cannot be taught only theoretically and passed. The laboratory use skills of the prospective teachers who will teach this course will be an important factor that will affect whether they will teach theoretically or using the laboratory while teaching with students (Önen & Çömek, 2011).

Sometimes laboratories are not suitable in terms of physical appearance and number. Having only one laboratory in schools and teachers using the laboratory within a program sometimes causes problems. When the physical inadequacy of the laboratory is added to this situation, usage becomes even more difficult. In the study conducted by Bozdoğan and Yalçın (2004), it was determined that there are laboratories in almost every school, but that the laboratories do not have the capacity to teach lessons. Similarly, in the study conducted by İspir et al. (2007), it was determined that teachers found the number of laboratories insufficient and the existing laboratories and practices inadequate.

Laboratory practices and experiments and activities carried out during the laboratory process improve the technical skills of the students. Students with technical skills recognize the features of laboratory equipment, their intended use, and design experiments and activities by using laboratory equipment appropriately (Çepni, 2015). Teachers with technical skills are aware of laboratory safety and accidents that may occur in the laboratory (Aydoğdu & Şener, 2016). Therefore, it is important for prospective teachers, who are future teachers who will conduct laboratory courses in the future, to use laboratory equipment appropriately and appropriately for an effective science teaching process (Çıldır, 2012; Kaymak & Karademir, 2019).

The majority of teachers stated that some of the activities were too simple for the students' levels, their numbers were too many and their contents were heavy, there were activities for the same purpose in the curriculum, the information part of

the activities was missing, students could not understand the subject by just doing the activities, and students could not reach the results they needed to achieve on their own. Especially due to low student levels and their inability to comment, teachers do the activities that students should do themselves and show them to the students, thus preventing students from reaching a wrong conclusion. However, in the structuralist approach, activities are carried out by the students and the teacher guides them. In addition, in a study conducted by Gömleksiz and Bulut (2007), it was emphasized that the learning environments created with the science and technology curriculum should be supported by well-equipped science laboratories, and the needs in this direction should be met, and it should be ensured that the teachers mainly teach the subjects based on experiment and observation in the laboratory environment (Karakolcu Yazıcı & Özmen, 2015).

The fact that some administrators do not have a digital background causes them not to have much knowledge about the science branch and laboratory, and therefore they are inadequate in producing solutions to laboratory-related problems. Teachers are reluctant to use the laboratory because administrators are indifferent to problems (Karakolcu, 2009). As a result of the study, it is a positive situation that the number of teachers who said that students expect us to do laboratory applications is high. This result shows that laboratory practices are carried out for the wishes and benefit of the students, as well as for the pressure and supervision of the teachers, the school administration, the Ministry of Education and the inspector.

Teachers should be encouraged to allocate more time to laboratory work in science classes. In order for the laboratory to be used effectively, the equipment in the laboratory must be sufficient and the use of the equipment must be renewed by the administration. Laboratory materials should be introduced to the student at the beginning of the education period. The student must be taught the methods to be used in laboratory work. Students should be encouraged to be active while experiments are being carried out. After the laboratory activities are done, students should be asked to report their observations. At the beginning of the lesson, students should be reminded of the procedures that need to be done and the student should be guided (Yazıcı & Kurt, 2018).

Considering that all these results are evaluated holistically, and considering that science is one of the courses that many individuals have the most difficulty with, it is thought that experimental applications can make an important contribution to overcoming this difficulty experienced in science-oriented courses. While the use of laboratory approaches in science motivates students and makes them eager to learn science, research shows that some science teachers do not use laboratories due to the lack of laboratories in their schools and the inadequacy of laboratory materials (Dindar & Yaman, 2003; Yapıcı & Yapıcı, 2003; Bozdoğan & Yalçın, 2004; Çepni et al., 2005). There are also studies showing that the majority of teachers need in-service training on laboratory use (Anılan et al., 2020; Demir et al., 2011). Finally, in science teaching, it is emphasized that permanent and meaningful learning occurs by doing and experiencing, "If I hear, I forget, if I see, I remember, if I do, I learn." the principle should never be ignored.

5. SUGGESTIONS

1. Teachers can be given in-service training on the use of laboratories.

2. Students should be made aware of the laboratory culture and values.

3. Science laboratory materials and laboratory safety rules can be taught at the beginning of science laboratory courses.

4. It was the material issue that teachers complained most about. For this reason, material deficiencies need to be eliminated through both the school administration and the Directorate of National Education.

5. Laboratories regarding safety should be developed and school administrators should focus on this issue.

6. Since laboratory applications are carried out within the scope of the science course, they do not reach the necessary importance, sometimes due to the exam-oriented system, lack of time, and sometimes due to the students' perception of the experiments as games. For this reason, it should be ensured that individual experiments are carried out so that they can work like scientists.

7. It should be tried to determine the opinions and thoughts of the teachers who are practitioners regarding the applicability levels of the experiments and activities in the science and technology textbooks.

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