Science Teachers' Attitudes Towards Laboratory Practises and Problems Encountered

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Abstract

This study was carried out to determine whether laboratory attitudes of science teachers working in secondary schools change according to their gender, graduation field, term of service, location of their schools and teachers' participation into in-service training courses. The study comprises science teachers working in the center, towns and villages of Bitlis, Turkey between 2013 and 2014. Since it was easy to reach all the teachers in the study, sampling method was not used, and instead, the research was carried out with 110 teachers. For data analysis, SPSS 17.0 was used.

As a result of this study, teachers clearly stated that laboratory practices in science classes had a great importance to draw students' attention and ensure effective learning. However, this study found out that teachers are not familiar with tools and equipment in the laboratories and unable to use them. They do not have any knowledge of maintenance and repair of these tools and equipment. The study also revealed that teachers are unable to use teaching methods and techniques effectively in lab classes.

Keywords: Science Teachers, Laboratory Practices and Attitudes

1.Introduction:

Developments in science and technology change the world rapidly. Thus, primary objective of the society should be founding a science and research based information-society which makes science and technology. The basic step in the development of the information society is raising a new generation that is able to follow changes and developments the world and this is only possible by designing learning environments that emphasizes learning by doing. One of the best places where students can practice learning-by-doing is science labs at schools. In these labs, students may learn science subjects more effectively and discover basic concepts, principles and laws of science through experiments. Lab studies provide students to participate science activities, learn scientific methods and appreciate it. Moreover, they let students observe and develop their ability to generate ideas and make comments. (Ayas et. al 1994). Student also develop their reasoning, critical thinking and problem solving abilities via lab studies. (Kaptan, 1998).

Researches show that students' success in science courses in Turkey is significantly lower than other classes and also other countries (Serin, 2002). Among many factors causing this result, teachers' lack of lab practices may be counted. Many researchers working in the field of science education indicate that when teachers are not aware of the nature of science, it is almost impossible for them to help students understand concepts related to science. (Hadson, 1998; Palmquist and Finley, 1997).

The information, abilities and attitudes to be given to the students through laboratory studies are directly proportional to teachers' knowledge, abilities and attitudes towards these studies. Many researches on this subject have reveal that lab studies are necessary in sciences classes yet they state that this need is not sufficiently fulfilled. (Ayas et. al, 1994; Alpaut, 1984; Gürdal, 1991). Science teachers list the blocking factor in using laboratory as lack of materials, fewer class hours, an unsuitable environment, difficulty of controlling students in a laboratory environment. (Akdeniz et. al, 1999).

One of the reasons why science teachers have few laboratory classes is because they were not educated to use hands-on-training during their educational life. They were not educated in how to conduct an experiment, design it, develop it and use lab methods. (Öztaş and Özay, 2004). Another study indicates that one main reason of not being able to use laboratory in science classes is because in-service-training courses for lab studies are not available enough for science teachers. (Nakiboğlu and Sarıkaya, 1999). This study found out that in-service-training courses are carried out far from the regions where science teachers work and thus they do not have time attend such courses.

It is an indisputable fact that science is the basis of the technological developments of the last century. The development of science is based on environmental and laboratory researches. Laboratories, which have begun to take place in school programmes since the mid-19th century, were initially used to as demonstrations after giving the theoretical information but today they are widely used in students' individual and group tests. In Turkey, the importance natural sciences (Physics, Chemistry and Biology) have been observed by the ministry officials and especially science teaching programme that was applied in USA during 1960s has begun to be used. One of the various reasons of this is insufficiencies and deficiencies of applying laboratories in science classes although the role and importance of labs in science teaching is theoretically accepted by authorities. In order to use laboratories in science classes more effectively, objectives and methods of laboratory use must be properly known. (Ayas et. al., 1994).

2.Method:

Pattern: The research will be in scanning model. Scanning method is a research method that aims to describe a past or existing condition as it is seen. In this research model, events, objects and

individuals are described in their conditions as they are seen without any interference. (Karasar, 1998).

2.1. Scope and Sample

The study comprises science teachers working in secondary schools in Bitlis, Turkey.

Samples of the research are science teachers working in the center of Bitlis and Tatvan between 2013 and 2014

2.2. Data Collection

Data collection tool consists of two parts. The first part of the questionnaire includes multiple choice questions determining variables concerning teachers' profiles in terms of their gender, field, professional seniority, participation into in-service-training and the district of the school they work. The second part includes a scale of laboratory attitudes of science teachers. The scale is a likert-type scale which consists of 18 items. Teachers, who completed the questionnaire, were asked to choose one of the options in multiple-choice questions and likert-type questions. Likert-type questions included the following choices: 1. Strongly Disagree 2. Disagree 3. Neither Agree nor Disagree 4. Agree 5. Strongly Agree. Thereby, each teacher completing the questionnaire were graded out of 5 points in terms of their attitudes towards laboratory practises, and this score was used as the dependent variable in the statistical analysis. Before the analysis, questionnaires were examined to check whether they were exactly filled by teachers or not. 110 questionnaires were found out to be valid. Analyses were carried out on the basis of this survey.

2.3. Data Analysis

Collected data were analysed with SPSS 17.0. In this analysis, first descriptive statistics (frequency, percentage, mean, standard deviation, coefficient of skewness, and kurtosis coefficient) were calculated and then features of statistical distribution were revealed. T-test and variance analysis were used for data analysis.

3. Findings

3.1. Science Teachers' Attitudes Towards Laboratory Practises in Science Classes

a) Is there a significant difference by gender? When science teachers involved in the study are examined according to their genders, 52 out of 110 teachers (47,3 %) are female and 58 of them (52,7 %) are male. This result indicates that more than half of the science teachers working in Bitlis are male.

Table 1: Science teachers' attitudes towards laboratory practises by gender

Gender	N	Mean	Std. Deviation	T	P
Female	52	3,4573	,39462	2,331	,022
Male	58	3,6274	,37071		

According to Table 1, since P is less than 0,05, there is a significant difference. In terms of laboratory attitude among science teachers by gender, there is a significant difference in favour of male teachers

b) Distribution of science teachers in terms of their graduation: When the teachers, who participated in the survey, are examined in terms of their graduation, 104 teachers working (94,5 %) in secondary schools are graduates of Science Teaching Department and others are as follows: 1 (0.9 %) from Physics Teaching, 1 (0.9 %) from Chemistry Teaching, 1 (0.9 %) from Physics, 1 (0.9 %) from Chemistry, 2 (1.8 %) from other departments. According to these results, it is understood that a large majority of science teachers working in schools affiliated to the Ministry of Education in Bitlis are graduates of science teaching department. Since graduates of chemistry and physics teaching departments among teachers participating in the survey is very low, the data related to these teachers were not added into the analysis. .

Table 2: Laboratory Attitudes of Science Teachers according to their Graduation

Graduation	N	Mean	Std. Deviation	T	P
Science Teaching Department	102	3,5605	,39378	1,211	,229
Other Departments	6	3,3611	,34916		

Since p is higher than 0.05 in table 2, a significant difference does not exist. Among the graduates of science teaching department, a significant difference does not exist in terms of their laboratory attitudes.

c) Distribution of Science teachers according to their professional seniority: Among science teachers participated in the survey, 34 teachers (30,9 %) have been working less than 1 year, 48 teachers (43,6 %) between 1 and 5 years, 19 teachers (17,3 %) between 6 and 10 years, 7 teachers (6,4 %) between 11 and 15 years and 2 teachers (1,8 %) have been working more than 15 years. Thus, it is observed that a large majority of teachers participated in the survey are new in their professions or they have low seniority.

Table 3: Laboratory Attitudes of Science Teachers in terms of their professional seniority

Length of Service	N	Mean	Std. Deviation	F	p
0-1 Year	34	3,6078	,34679		
1-5 Year	48	3,5266	,46027		
6-10 Year	19	3,5058	,31530	,341	,850
11-15 Year	7	3,5397	,31706		
15 Year or more	2	3,4167	,19642		
Total	110	3,5470	,38988		

In table 3, since p is higher than 0,05, there is not a significant difference in laboratory attitudes of science teachers in terms of their professional seniority

d) Distribution of science teachers according to the location of schools they work: When distribution of teachers participated into the survey were examined according to location of schools they work, it is seen that 33 (30 %) teachers work in city centre, 52 teachers (47,3 %) work in towns and 25 teachers (22,7) work in villages. Since the number of secondary schools in towns and villages is more than the ones in city centre, this result is not surprising.

e) Distribution of science teachers according to their attendance to in-service-training: When teachers' attendance to in-service training for laboratory studies is taken into consideration, 17 of the teachers (15,5 %) stated that they had attended in-service-training while 93 teacher indicated that they had not attended any in-service-training before.

According to these results, it can be concluded that a large majority of science teachers working in Bitlis have not attended any in-service training for lab studies before or such courses are rarely held for the teachers working in this region. However, this result is not surprising when teachers' professional seniority is taken into account because most of the teachers participated in the survey were in their first years in their profession and they are likely to unable to find any opportunity to attend such courses yet. Moreover, since most of the teachers in the survey work in towns and villages rather than working in the city centre, they may not able to attend activities held in the city centre.

Table 4: Laboratory attitudes of science teachers in terms of their attendance to in-service-training

In service training	N	Mean	Std. Deviation	t	P
Attended	17	3,5294	,41995	0,201	,841
Not Attended	93	3,5502	,38647		

In table 4, since p is higher than 0,05, laboratory attitudes of science teachers do not have any significant difference in terms of their attendance to in-service-training.

f) Laboratory usage of Science teachers in their classes, Distribution of science teachers' laboratory attitudes in terms of the frequency they use laboratory.

Table 5: science teachers' laboratory attitudes in terms of the frequency they use laboratory.

	N	Mean	Std. Deviation	F	p
Never use	34	3,3268	,35501		
Once during a term	3	3,3148	,37816		
Once a month	12	3,4028	,27229		
Once every three weeks	3	3,5741	,08486	6,443	,000
Once every two weeks	15	3,5074	,26466		
Once a week	25	3,7044	,33744		
When students want	1	3,7222	.		
In all science classes	17	3,9183	,39534		
TOTAL	110	3,5470	,38988		

According to table 5, since p is less than 0.001, the relation between science teachers' laboratory attitudes and the frequency of their laboratory use were examined and teachers who use laboratory in all their classes were found to have the most positive attitude in terms of laboratory usage.

There have been various studies concerning laboratory usage and its reasons over past years. (Nakipoğlu and Sarıkaya, 1999) (Özmen and Ayas, 2001) (Ocak et. Al.., 2005). Particularly lack of lab tools and unavailability of existing tools are factors that limit effective use of laboratories. In this regard, for in-service training to be held in the future, teachers' abilities to use and repair lab tools need to be developed.

It is understood that teachers have positive attitudes towards the importance of lab practises.

4. Discussion and Suggestions

In this study, which aims to find out attitudes and views of science teachers' towards laboratory studies who work in secondary schools in Bitlis, it is found out that a large majority of teachers are graduates of science teaching departments, more than half of them are male, majority of them are young and they work in towns and villages. Also, a vast majority of the teachers have never attended any in-service-training before.

Table 6. Distribution of attitudes and opinions of science teachers towards laboratory studies N=110

No	Statements	*Totally Agree*	*Agree*	*Undecided*	*Disagree*	*Totally Disagree*
		%	%	%	%	%
1	Our schools has an available science laboratory for science classes	22,7	20,9	6,4	20,9	29,1
2	We use the science lab in our school at the desired level	13,6	65,5	18,2	2,7	0
3	Science teaching can best be carried out in a lab	50,0	32,7	6,4	9,1	1,8
4	I believe that science teaching is more permanent it done by using visual materials and laboratory.	79,1	18,2	2,7	0	0
5	I believe that experiments we conduct in lab are effective.	53,6	40,9	2,7	1,8	0,9
6	I know all the tools used in science lab	12,8	50,9	21,8	13,6	0,9
7	I exactly know how to use all tools used in science lab	19,1	45,5	18,2	16,4	0,9
8	I think I have enough knowledge and experience to be able to plan the work of the science laboratory	25,5	48,2	16,4	10,0	0
9	Implementation of experiments to be done in science courses is difficult	5,5	20,9	18,2	43,6	11,8
10	I think experiments done in science classes are not chosen from daily life.	10,9	21,8	19,1	42,7	5,5
11	The applicability of science experiments is weak.	3,6	8,2	14,5	51,8	21,8
12	Having a crowded class is a factor that keeps teachers and students away from doing laboratory studies.	46,4	32,7	10,0	5,5	4,5
13	Lack of appropriate physical conditions of the laboratory keeps teachers and students away from doing laboratory studies.	57,3	33,6	0	9,1	0

14	Science lab studies are enough to concretise abstract information.	18,2	43,6	19,1	15,5	3,6
15	I take lab studies as a criterion to determine students' grades.	5,5	37,3	25,5	26,4	5,5
16	Since laboratory classes have some dangers, teachers and students are not voluntary to do laboratory studies	8,2	30,9	19,1	32,7	9,1
17	I think in-service training courses by the Ministry of Education that aims at improving laboratory practices are useful.	20,0	35,5	22,7	13,6	8,2
18	I would like to attend in-service courses aimed at improving science laboratory applications	50,9	32,7	9,1	5,5	1,8

When science teachers' attitudes and views towards laboratory studies are examined, teachers generally have a positive attitude against laboratory. This is an expected situation because laboratory studies teaches by doing and thus provides the learned information to be permanent. It also develops students' creativity and ability to solve problems, which also creates a positive sense towards lab among teachers.

Teachers' gender, graduation field, term of service, location of their schools and their participation into in-service training courses were researched to determine whether these factors affect teachers' laboratory attitudes or not. Results show that there is significant difference between teachers' attitudes towards laboratory studies and their gender. Whereas, a significant difference was not found according to their period of service and graduation field.

Is is also understood that although teachers participated in the survey are graduates of science teaching, biology, chemistry and physics departments, there is not any significant difference between teachers' attitudes and their graduation. The necessity of laboratory practises in these fields, which are basics of science, is indisputable. Furthermore, it is understood that teachers, who have attended in-service-training courses before, know methods and techniques used in laboratories and they apply them in their classes.

In his study,"Basic Educational Problems in Turkey and their Solutions", Başaran states that appropriate teaching methods are not used in classes. He lists the reasons for this problems as the following: classes are crowded, laboratory classes are more tiring when compared to lecturing classes, teachers, parents and students believe that laboratory studies are waste of time, schools do not have experts working in laboratories, teachers are afraid of failing in scientific experiments, teachers think that they will not be able to manage students in lab, labs have insufficient materials.

Since teachers do not get prepared for the experiment in advance and there is not enough space in schools for lab, teachers ignore having lab studies.

One study carried out by Demir and Erol indicates that science teachers have a common belief that laboratory studies get students' attention and provides effective learning. In addition, the study finds out that teachers do not know the tools in lab enough, they are insufficient in using and repairing these tools, and also, they do not use teaching methods and techniques effectively.

As a conclusion, it is a fact that science teachers' opinions and practices for experiments has a crucial role. According to the results of this study, the following suggestions are possible:

1. Topics in science classes should be reconciled with everyday life and they should be handled in accordance with scientific process skills.
2. Teacher training courses given to science teachers should be made at regular intervals and these courses must be converted into practical vocational training rather than presenting theoretical information.
3. From time to time, new developments and curricula are integrated into our education system. All teacher must attend the introductory seminars of these programmes that are held in city centres and they must be informed about new developments in education. This is important for the development of education and its quality.
4. Laboratory classes mustn't be at random times. They must be scheduled at the beginning of each semester by teachers.
5. In science teaching departments at universities, laboratory applications, use of tools and experiments that can be done with simple materials must be taught to students more.

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