# Science Teachers' Qualifications towards Laboratory Practises and Encountered Problems

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Abstract:

This study aims to find out whether science and technology teachers' views on their competency for laboratory practices differ in terms of their genders, graduation fields, years of service, location of schools and participation into in-service trainings. The scope of the study covers science and technology teachers working in Bitlis city center, its towns and villages during 2013-2014 education year. A total of 110 teachers participated in the research. For data analysis, SPSS 17.0 software package was used.

As a result, science and technology teachers stated that laboratory practices played an important role in drawing students' attention to the course and providing effective learning. Besides, the study found out that teachers did not know, use and maintain tools in laboratories. They were also not able to use laboratory methods during the classes.

Key Words: Science and Technology Teachers, Laboratory Qualifications and Attitudes

1. Introduction:

Today, it is quite difficult to keep up abreast of new inventions and rapidly developing science and technology. From computer to space and communication technology, the dizzying speed of these developments led to changes in social structure and keeping up with these changes, being equipped with the knowledge and skills required by the age became necessary for people in order to build a better future for their countries.

To take advantage of changing and developing technologies in order to capture the era, people need to follow, understand and adapt them in a short time. To achieve this, individuals who know what, why and how to learn and are able to get, evaluate and produce knowledge are required. Only nations that have information society on these conditions will be able to take place at the forefront of economic and technological competition.

Rapidly developing science and technology change features that individuals need to have in the future. Therefore, schools need to raise independent, creative, critical, self-confident students who can understand and use changes in technology, solve the problems they confront through scientific knowledge. Students need to acquire lifelong learning skills in order to become investigating and interrogating individuals and learn new things throughout their lives. To acquire these skills, they should have a good educational process from primary school to higher education. (Aydede, 2006, 1)

Today, the need for teachers who really know and can perform learning and teaching is increasing. Due to changing economic, social and technological conditions, organizations feel obliged to change their human resource policies and improve their performance. Thus, these organizations put more emphasis on education and development in their strategic priorities. ( Barutçugil, 2002, 80).

The teacher, as an individual who develops and dominates teaching and motivate students, is one of the most important elements of educational progress. (Yılmaz ve Morgil 1999,182). In order to achieve required qualifications, teachers need to have some standards and these standards are achieved through teachers' proficiency.

Gürdal, Çağlar and Şahin (1997) state that man attributes meaning to events according to his own perceptions. The role of the teacher in science classes is not teaching his students stereotyped information, but rather helping them increase their interests towards events first to knowledge level and then learning level.

Science teachers can use many methods and techniques according to the content of the subject. However, laboratory usage, which is commonly used and provides permanent learning, is a method that puts emphasis on mental activity and allows students to work individually or in groups (Staeck, L.1995). It is widely known that laboratory practices contribute to students' personal skills and teach them how to observe and use knowledge. Students also understand scientific terms, keep

them in their minds, think critically, create and interpret knowledge through laboratory practises. (Staeck, L.1995; Algan Ş., 1999).

In lab studies; knowledge, skills and attitudes that are aimed to teach students are directly proportional to teachers' knowledge, skills and attitudes. Researches done on this subject reveals that laboratory practises are necessary in science classes yet they are not carried enough by teachers (Alpagut, O.,1984; Gürdal, A.,1991). Some studies also reveal that lack of materials, inadequate class hours, unsuitable learning environment, lack of adequate knowledge about the laboratory and poor classroom management in lab atmosphere are among factors that prevent teachers to use laboratories(Yalın, H. I. , 2001).

## 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

As data collection tool, during the development of self-efficacy scale, after examining previous applications that have been made on the issue, proficiency scale regarding laboratory practice that has been developed by Kaya et. al. and Böyük et al. was used.

Data collection tool consists of two parts. The first section of the survey includes questions that determine teachers' profiles in terms of their gender, fields, professional seniority, the location of the school they work and their participation into in-service training programmes.

The second section of the survey consists of self-efficacy scale for laboratory practices that aims to determine self-efficacy level of laboratory practises. The scale is likert-type including 18 items.

Teachers participated into survey were asked to select one of the choices in multiple-choice questions. For graded questions, they were asked to select one of the choices that define how much they agree to a statement, choices are as the following: 1) sure of insufficiency 2) insufficiency 3) partly sufficient 4) Sufficient 5) Sure of sufficiency. Thus, each teacher completing the survey was graded out of 5 points in terms of Self-efficiacy for laboratory practises and this grade was used as the dependent variable in 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 Findings of the relation between science teachers' profiles, their personal variables and their competency feedback on lab studies.

Profile of secondary school teachers ($6^{th}$, $7^{th}$ and $8^{th}$ grades) who work in Bitlis and participated the survey about their competency feedback on lab studies is given below:

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' competency feedback about laboratory practices in terms of their gender

| Gender | N | Mean | Std. Deviation | T | P |
|---|---|---|---|---|---|
| Female | 52 | 3,9925 | ,45321 | 0,983 | 0,328 |
| Male | 58 | 3,8898 | ,61903 | | |

According to table 1, since p is greater than 0.05, there is not any significant difference of science teachers' competency feedback about laboratory practices in terms of their gender

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.

**Table 2:** Science teachers' competency feedback about laboratory practices in terms of their graduation fields

| Graduation | N | Mean | Std. Deviation | T | P |
|---|---|---|---|---|---|
| Science Teaching Deparment | 104 | 3,9642 | ,51187 | 2,094 | 0,039 |
| Other Departments | 6 | 3,4907 | ,93255 | | |

Since p is less than 0,05 in table 2, graduates of science teaching department have greater self-efficacy level when compared to the graduates of other department

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:** Science teachers' competency feedback about laboratory practices in terms of their length of service:

| Length of Service | N | Mean | Std. Deviation | F | P |
|---|---|---|---|---|---|
| 0-1 Year | 34 | 4,0000 | ,59380 | | |
| 1-5 Year | 48 | 3,9560 | ,50150 | | |
| 6-10 Year | 19 | 3,9737 | ,45639 | 1,756 | 0,143 |
| 11-15 Year | 7 | 3,4206 | ,74733 | | |
| 15 Year and more | 2 | 3,9444 | ,07857 | ,05556 | |
| Total | 110 | 3,9384 | ,54694 | ,05215 | |

According to table 3, since p is greater than 0,05, there is no significant difference in Science teachers' competency feedback about laboratory practices in terms of their length of service in teaching.

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:** Science teachers' competency feedback about laboratory practices in terms of their participation into in-service training.

| In-service training | N | Mean | Std. Deviation | t | P |
|---|---|---|---|---|---|
| Participated | 17 | 3,9248 | ,44572 | 0,111 | 0,912 |
| Not Participated | 93 | 3,9409 | ,56554 | | |

Since p is greater than 0.05 in table 4, there is no significant difference in Science teachers' competency feedback about laboratory practices in terms of their participation into in-service training

Science teachers' competency feedback about laboratory practices, their answers to survey questions and percentage values are given in table 5. Since a lot of teachers selected "Sure of insufficiency" choice in the survey questions, the percentage of this choice in table 5 is shown very little.

This situation can be explained as the following: in terms of competence and practice of laboratories, teachers do not either feel themselves completely inadequate or they want to express any opinion about it. Moreover, it is possible to claim that most of the teachers participated into the survey feel themselves sufficient or sure of sufficiency.

Science teachers believe that they feel themselves sufficient in all of the items, sure of sufficiency in item number 1, 8, 9, 13, 14, 15, 16, 17, 18 and insufficient for item number 2, 3, 4, 5, 6, 7, 10, 11, 12.

Besides, for statements "Having the knowledge and skills related to simple maintenance equipment in the laboratory" (49,1 %) and "Having knowledge of measuring students' attitudes regarding their laboratory studies" (39 %), teachers feel themselves either insufficient of partly sufficient.

From past to present, various studies have been carried out to reveal problems experienced in the use of laboratories and reasons to use laboratories . (Nakipoğlu ve Sarıkaya 1999) (Özmen ve Ayas, 2001) (Ocak ve ark., 2005). In particular, the lack of tools or the existing tools to be unavailable in laboratories are important factors that limit the effective use of laboratories. In this regard, for in-service training that will be given to teachers in the future, it is understood that

applications and notifications that will enhance teachers' using and repairing the lab equipment should be made.

On the other hand, most of the teachers feel themselves sufficient or sure of sufficiency for statements number 1, 8, 9, 13, 14, 15, 16, 17, 18. Thus, it is clear that teachers have positive opinions about the importance of laboratory studies in science and technology courses.

Correlation coefficient was determined by calculating the correlation between the question "How often do you use laboratories in your classes?" and teachers' self-efficacy. Pearson correlation coefficient was found as $r=0,219$; $p<0,05$ which means that teachers who use laboratories more often have a higher self-efficacy level.

**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 5.** Distribution of Science teachers' competency opinions about laboratory studies

| Item no | Statements of Sufficiency | *Sure of Sufficiency* | | *Sufficient* | | *Partly Sufficient* | | *Insufficient* | | *Sure of insufficiency* | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **f** | **%** | **f** | **%** | **f** | **%** | **f** | **%** | **f** | **%** |
| **1** | Knowing the importance of laboratory methods in science teaching | 37 | 33,6 | 60 | 54,5 | 10 | 9,1 | 2 | 1,8 | 1 | 0,9 |
| **2** | Knowing teaching methods and techniques that are used in laboratory studies | 15 | 13,6 | 72 | 65,5 | 20 | 18,2 | 3 | 2,7 | 0 | 0 |
| **3** | Ability to use teaching methods and techniques that are used in laboratory studies | 14 | 12,7 | 61 | 55,5 | 29 | 26,4 | 5 | 4,5 | 1 | 0,9 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **4** | To have all the necessary knowledge and skills to create a safe working environment in the laboratory | 18 | 16,4 | 59 | 53,6 | 30 | 27,3 | 2 | 1,8 | 1 | 0,9 |
| **5** | Ability to know and use all the tools in science lab | 12 | 10,9 | 64 | 58,2 | 28 | 25,5 | 4 | 3,6 | 2 | 1,8 |
| **6** | Having the knowledge and skills related to simple maintenance equipment in the laboratory | 7 | 6,4 | 47 | 42,7 | 39 | 35,5 | 15 | 13,6 | 2 | 1,8 |
| **7** | To be able to organize an effective teaching environment in the laboratory | 17 | 15,5 | 65 | 59,1 | 25 | 22,7 | 3 | 2,7 | 0 | 0 |
| **8** | Being willing to use laboratory methods in the course | 34 | 30,9 | 58 | 52,7 | 15 | 13,6 | 3 | 2,7 | 0 | 0 |
| **9** | Being curious of the new tools developed for science and technology education and willing to use them in class | 33 | 30,0 | 51 | 46,4 | 23 | 20,9 | 3 | 2,7 | 0 | 0 |
| **10** | Have the ability to develop and use simple tools for laboratory studies | 26 | 23,6 | 45 | 40,9 | 30 | 27,3 | 6 | 5,5 | 3 | 2,7 |
| **11** | Having the knowledge of measuring students' knowledge and skills related to laboratory work | 12 | 10,9 | 62 | 56,4 | 31 | 28,2 | 4 | 3,6 | 1 | 0,9 |
| **12** | Having knowledge of measuring students' attitudes regarding their laboratory studies | 16 | 14,5 | 51 | 46,4 | 38 | 34,5 | 5 | 4,5 | 0 | 0 |
| **13** | Selecting the appropriate tools for a given experiment | 34 | 30,9 | 61 | 55,5 | 13 | 11,8 | 2 | 1,8 | 0 | 0 |
| **14** | Establishing a testing apparatus with accurate testing tools | 28 | 25,5 | 54 | 49,1 | 22 | 20,0 | 6 | 5,5 | 0 | 0 |
| **15** | Following safety rules when using equipment | 35 | 31,8 | 56 | 50,9 | 18 | 16,4 | 0 | 0 | 1 | 0,9 |
| **16** | After the experiment, putting equipment in their places clean and regularly | 43 | 31,9 | 52 | 47,3 | 12 | 10,9 | 1 | 0,9 | 2 | 1,8 |
| **17** | Interpreting test results | 43 | 31,9 | 60 | 54,5 | 6 | 3,6 | 3 | 2,7 | 0 | 0 |
| **18** | Achieving new results by combining experimental results with theoretical knowledge | 40 | 36,4 | 53 | 48,2 | 12 | 10,9 | 4 | 3,6 | 1 | 0,9 |

While examining science teachers' competency opinions about laboratory studies, it is found that science teachers generally find themselves sufficient in terms of knowing and using lab methods and techniques and they have a positive attitude towards laboratory studies. Since laboratory studies provide learning by doing, thus letting the information be permanent, and develop students' creativity and problems solving skills, it is an expected result that teachers have positive attitudes towards laboratory studies.

Whether teachers' gender, professional seniority, location of the school they work and their participation into in-service training affect their competency opinions about laboratory studies have been searched. Results show that there is not any significant difference of science teachers' competency feedback about laboratory practices in terms of their gender.

Science and technology teachers that are graduates of science teaching, biology, chemistry, physics department do not show any significant difference about their competency feedback about laboratory practices in terms of their graduation fields. 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, "Turkey's Compulsory Education Problems and Solutions", Başaran (1974) states that teachers do not use the appropriate teaching methods in their classes. In this regard, it is possible to say that teachers participated in this study may have insufficiencies in terms of using appropriate methods. The result of this insufficiency may definitely lead to situations that will affect teachers' laboratory activities.

Therefore, since teachers' average competency level related to laboratory applications is above the mean, reasons that prevent teachers' to have laboratory studies should not be ignored.

The reasons for this can be listed as the following: crowded classes, it is more exhausting for teachers to teach in lab than lecturing in the class, students, teachers and parents see lab studies as a waste of time, lack of laboratory assistants for laboratories at schools, teachers' fear of failure during the experiment and also fear of not dominating students, lack of absence of lab tools.

The preparation that must be done in advance before lab studies and the lack of a dedicated laboratory space in schools are reasons that prevent teachers from carrying out laboratory studies. Akgün (1985) and Gürdal (1991) found similar results in their studies.

In a study carried out by Uğur BÖYÜK, Semra DEMİR ve Mustafa EROL (2010), it is concluded that using labs in science and technology classes play a very important role in drawing the attention of students to the course and ensure effective learning.

Furthermore, the study revealed that teachers do not know tools and equipment in labs enough and cannot use them, they do not also have the knowledge of repairing and maintenance of these tools. It was also found that teachers were not able to use teaching methods and techniques in their classes 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)Support centres where teachers can learn how to use lab tools, repair them should be established.

(4) 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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