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Araştırma Makalesi / Research Article

Fizik Öğretmen Adaylarının Öğrencilerin Fizik Laboratuvar Performansını Değerlendirmeyi Öğrenmesi

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Özet – Raporlanmış durum çalışması 36 fizik öğretmen adayının, öğrencilerin okul fizik laboratuvarındaki başarılarını değerlendirme çabalarını araştırmayı hedeflemektedir. Katılımcılar 3. veya 4. sınıf lisans öğrencilerinden oluşmaktadır. Öğretmen adayları zorunlu olan bir fizik laboratuvar eğitimi dersi kapsamında, bir akademik dönem boyunca laboratuvar becerilerine ilişkin öğrenme kazanımları ve laboratuvar aktiviteleri geliştirmişlerdir. Öğretmen adayları ayrıca kendi sınıf arkadaşlarıyla uyguladıkları mikro öğretim deneylerinde ölçme değerlendirme metotları ve etkinlikleri de tasarlamışlardır. Bunun yanı sıra lise öğrencilerin laboratuvar raporlarına dönüt vermişlerdir. Bulgular, böyle bir sürecin öğretmen adaylarının kendi laboratuvar raporlarının da geliştirdiğini göstermiştir. Öğretmen adaylarının, öğrencilerin laboratuvardaki başarılarını değerlendirme sürecine ait zorluk ve güçlüklerini belirlemek ve anlamak için yarı yapılandırılmış mülakatlar yapılmıştır. Çalışmanın verisi 6 dönem (3 akademik yıl) süresince toplanmıştır. Başarı değerlendirmesi, öğretmen adaylarının eğitimi ve gelecek çalışmalara ilgili sonuçlar tartışılmıştır. Örneğin, öğretmen adaylarının öğrenci başarılarını değerlendirme becerilerinin geliştirilmesi fizik öğretmen eğitimin önemli bir parçası haline getirilmelidir.

Anahtar kelimeler: başarı değerlendirmesi, ölçme değerlendirme hedefleri, fizik laboratuvarı, fizik öğretmen eğitimi, durum çalışması.

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Geniş Özet

Fen ders programının uygulanmasına ilişkin bazı çalışmalar Türkiye'de yürütülmüştür (Balta vd. 2014; Demir & Demir, 2012; Elmas vd. 2010; Mercan, 2013; Sadi & Yıldız, 2012). Örneğin Mercan (2013) çalışmasında fizik öğretmenlerinin %90 nının sınıflarında deney yapmadıklarını ifade ettikleri kanısına varmıştır. Bu öğretmenlerin %82 si üniversite giriş sınav sorularının deneylerle ilgili olmadığını belirtmiştir. Ders programı ve üniversite giriş sınavının farklılıkları sebebiyle, öğretmenler öğretimlerine deneyleri dahil etmemektedirler. Mercan (2013) ün çalışmasında öğretmenlerin % 64 ü 2007 fizik öğretmen eğitimi programının ve üniversite giriş sınavlarının paralellik göstermediğini ifade etmişlerdir. Böylelikle Mercan (2013), öğretmenlerin ölçme değerlendirme metotları hakkında mesleki gelişme ihtiyaç duydukları sonucuna varmıştır. Sadi ve Yıldız (2012) da öğretmenlerin çoğunun başarı değerlendirme etkinlikleri kullanmadığını bulmuşlardır. Demir ve Demir (2012) ise çalıştıkları okul türü fark etmeksizin laboratuvar ekipmanları ve zamanı yetersizlikleri öne sürülerek uygulamalı etkinlikler yapılmadığını belirtmişlerdir.

Tablo 1 Fizik deneylerine ilişkin laboratuvar becerileri

Laboratuvar Becerileri
Deneyi planlar: Örneğin, değişken analizinin nasıl yapılacağını öğrenmek
Ölçüm sayısı (kaç tane yapılacağı), bağımlı değişken için hangi sıklıkta ölçüm yapılması gerektiği, ölçümlerin aralığı, kaç tane deneme yapılması gerektiği hakkında karar verir.
Grafik üzerine yerleştirilen verilerden en uygun doğruyu çizebilir.
Grafik üzerine yerleştirilen verilerden en uygun eğriyi çizebilir.
Deneysel veriyi analiz eder.
Hassasiyet ve kesinliği analiz eder.
Uç değerleri ve tesadüfî hataları belirler.
Sistematik hataları ve bu hataların kaynaklarını belirler.
Öğrenciler deneyin genel sonuçları hakkında tartışır.
Öğrenciler deneyin sonuçları ile elde edilen bulguların teoriler kullanılarak nasıl açıklanabileceğini belirtir.
Grafik(ler) yoluyla eğim hesaplar.
Verilerin güvenilir olup olmadığını değerlendirir
Verilerden hesaplamalar yapar.
İç değerleme ve dış değerleme hesabı yapar.
Deneydeki ölçümlerin, deney sürecinin ve tüm deneyin uygunluğunu değerlendirir.

Araştırma soruları

Bu rapor fizik öğretmen adaylarının öğrencilerin laboratuvardaki başarısını nasıl değerlendireceklerini öğrenme süreçlerine yönelik çabalarına odaklanmaktadır. Belirtilen 3 araştırma sorusu çalışmaya yön vermiştir:

1) Öğretmen adayları laboratuvar çalışmalarına yönelik öğrenme kazanımları geliştirirken ne gibi zorluklarla karşılaşmışlardır?

2) Öğretmen adaylarının laboratuvar performansını değerlendirme sürecindeki deneyimleri nelerdir? Öğretmen adayları hangi ölçme metotlarını ve laboratuvar aktivitelerini geliştirmişlerdir?

3) Öğretmen adayları öğrencilerin laboratuvar raporlarına hangi dönütleri vermiştir?

Araştırma Deseni

Araştırmada nitel durum çalışması yaklaşımı benimsenmiştir (Stake, 1995; Yin, 2003). Araştırma verisi (yukarıda belirtilmiş olan) ders kapsamında bir akademik dönem boyunca toplanmıştır. Altı katılımcı, akademisyenleri ve kendi aralarındaki iş birlikleri ile desteklenen bir akademik dönem geçirmişlerdir. "Nitel durum çalışması bir konuyu bağlam çerçevesinde derinlemesine, detaylı ve bütüncül bir biçimde betimlemeye çalışan araştırma desenidir" (Stake, 1995).

Bulgular

1. ***Laboratuvar becerilerine ilişkin öğrenme kazanımları geliştirmeyle ilgili zorluklar***

Laboratuvar becerilerini ölçmeye hazırlanmak katılımcılarımız için oldukça büyük bir zorluk yaratmıştır. Bu nedenle, katılımcılar ilk haftalarda laboratuvar becerilerini ölçme açısından kendilerine güvenmemişlerdir ve ölçmeye için geliştirdikleri öğrenme kazanımları da yeterli olmamıştır. Belirli laboratuvar becerilerini geliştirmeye yönelik öğrenme kazanımlarını yazmaya ilişkin zorlukları belirgindir. Sınıfta, sınavlarda ve ödevlerde gösterilenler gibi (Etkinlik 1 ve Etkinlik 2 sırasıyla Şekil 2 ve Şekil 3'te sunulmuştur) etkinlikler dağıtılmıştır. Bu etkinliklerle öğretmen adaylarının deneysel becerilere yönelik öğrenme kazanımları geliştirmelerine yardım etmek amaçlanmıştır.

2. Laboratuvar becerilerine ilişkin ölçme metotları, laboratuvar aktiviteleri ve ölçme *hedefleriyle ilgili deneyimler*

Etkinlik 4 ve Etkinlik 5 teki gibi laboratuvar etkinlikleri; sınıfta, ödevlerde ve sınavlarda dağıtılmıştır. Bu etkinlikler öğretmen adaylarının laboratuvar becerilerine yönelik ölçme metotları ve hedefleri geliştirilebilmelerine yardımcı olmak için tasarlanmıştır. Öğretmen adayları çoktan seçmeli sorular geliştirilmesi ve kullanılmasından başarı değerlendirmesi sürecine geçilmesi hakkında detaylı ifadeler kullanmışlardır. Bu geçiş, öğretmen adayları sadece çoktan seçmeli sorular kullanmaya ve geliştirmeye aşina oldukları için birçok ciddi zorluğu temsil etmiştir.

3. Öğrencilerin laboratuvar raporlarına verdikleri dönütler

Katılımcılardan lise öğrencilerinin laboratuvar raporlarına dönüt vermeleri istenmiştir. Bu raporlar liselerden alınmıştır ve araştırmacı tarafından katılımcılara sağlanmıştır. Öğretmen adayları laboratuvar raporlarının farklı kısımlarına (deneyin tasarlanması, ölçme araçlarının toplanması, analiz, prosedürlerin açıklaması ve değerlendirilmesi) yönelik yorumlarda bulunmuşlardır. Yorumları açık, geliştirilmeye uygun noktalar içeriyordu.

Sonuçlar ve çıkarımlar

Araştırma öncelikle fen ders programının uygulanması ölçme değerlendirme pratiklerine yönelik çıkarımlar içermektedir. Fizik eğitimi, laboratuvara ilişkin çalışmaları da içermelidir. İkinci olarak, çalışma fizik öğretmen eğitimiyle ilgili çıkarımlar bulundurmaktadır. Fizik öğretmen adayları laboratuvar becerileri için ölçme kazanımları ve metotları geliştirme açısından kendilerine güvenmelidirler. Laboratuvar raporlarına ve derslerdeki çalışmalara dönüt vermeyi deneyimlemelidirler. Araştırmanın bulguları fizik öğretmenlerinin hazırlanmasına yönelik dersler geliştirilmesi için güçlü kanıtlar sunmaktadır. Durum analizi yaklaşımı ile diğer durumlara genellenebilirlik veya geçerlilik düşünülmemelidir (Stake, 1995; Yin, 2003). Bu çalışma ile farklı ülkeler ve bağlamlarda fizik öğretmen eğitimi bölümlerinde yapılacak öğretmen adaylarının zorlukları ve başarılarına ilişkin çalışmalara bir öneri getirilmektedir.

Pre-Service Physics Teachers Learn to Assess Student Performance in the School Physics Laboratory

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Abstract – The reported case study aimed to investigate 36 pre-service physics teachers' efforts to learn to assess student performance in the school physics laboratory. The participants were in the third or fourth year of their undergraduate studies. They developed learning objectives closely related to laboratory skills and designed laboratory activities during a compulsory course about teaching in the physics laboratory for one academic term. They also developed assessment methods and assessment tasks, which they used when teaching experiments in microteaching (to their peers). In addition, they gave feedback to actual secondary students' laboratory reports. Evidence has shown that such a process helped them improve their own laboratory reports. Semi-structured interviews were conducted in order to identify and understand the difficulties and challenges they experienced related to the assessment of student performance in the laboratory. Data for the study were collected for six consecutive terms (three academic years). Implications for the implementation of performance assessment, pre-service teacher education and further research are discussed. For example, the issue of how to prepare pre-service teachers to become skillful in assessing student performance in the laboratory should be an important component of physics teacher education programs.

Key words: performance assessment, assessment goals, physics laboratory, physics teacher education, case study.

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Introduction

Over the years, several scholars, researchers and practitioners have argued that the laboratory is a unique resource for teaching and learning (Hofstein & Lunetta, 2004). In fact, physics is not only theory, concepts, laws and formulas. It is also an experimental science. Laboratory work is at the heart of physics. In Europe (i.e., France, Germany, the United Kingdom) and the US, the laboratory has had a prominent role in science teaching and learning from the 19th century (Hofstein & Lunetta, 1982, 2004; Tobin, 1990). For example, in the United Kingdom, the National Science Curriculum states that secondary students should "develop their ability to evaluate claims based on science through critical analysis of the methodology, evidence and conclusions, both qualitatively and quantitatively" (Department for Science Education, 2014) .

A number of seminal as well as most recent reviews on assessment of learning and teaching in the laboratory were published (e.g., Abrahams *et al.*, 2013; Doran *et al*., 1993; Hofstein & Lunetta, 1982, 2004; Hollins & Reiss, 2016; Lazarowitz & Tamir, 1994). In the review by Hostein and Lunetta (1982), "science laboratory activities" are defined as learning experiences in which students interact and/or with models to observe and understand the natural world. Lazarowitz and Tamir (1994) underlined that teachers were less confident about using appropriate assessment methods beyond paper-and-pencil tests to assess a range of important student skills. Abrahams *et al.* (2013), in their review on how practical work is summatively assessed in school science in a range of countries, reported that the literature on the assessment of school science practical work is much more limited.

Some research studies about the implementation of the science curriculum were conducted in Turkey (e.g., Balta *et al.*, 2014; Demir & Demir, 2012; Elmas *et al*., 2010; Mercan, 2013; Sadi & Yıldız, 2012). For instance, the study carried out by Mercan (2013) provided evidence that 90% of the physics teachers stated that they did not do experiments in their classes. 82% of them explained that the questions in the university entrance exams are not related to experiments. Because of the mismatch between the curriculum and the university entrance exams, they did not include experiments in their teaching. As Mercan's study showed, 64 % of the teachers argued that the 2007 physics teaching program and the university entrance exams were not aligned. Thus, Mercan concluded that teachers do need professional development related to assessment methods. Sadi and Yıldız (2012) also found out that most teachers did not use performance assessment tasks. It is worth reporting that Demir and Demir (2012) suggested that the teachers, regardless of the school type they are working, refer to the lack of laboratory equipment and time, not as genuine explanations for not doing hands-on activities but merely as an excuse.

The issue, then, of how to prepare pre-service teachers to become skilful in teaching and assessment in the laboratory should be an important component of teacher education programs. As Bransford, Brown and Cocking (2000) argued, newly qualified teachers need help in order to use relevant knowledge that they have acquired. They usually need feedback and reflection so that they can try out and adapt the already acquired skills and knowledge in new environments. From the same perspective, Shulman (1986) argued that the transition from expert learner to novice teacher is a difficult one. As Feiman-Nemser (2001) and Luft (2009) emphasized, beginning teachers have much to learn, including knowledge of students' needs and interests and students' learning of science, as well as pedagogical content knowledge. Similarly, Roberts and Gott (2006) argued in favour of teacher preparation for more effective implementation of performance assessment.

Content knowledge alone is not sufficient for good teaching. Teachers need support in learning the core ideas of the discipline, as well as how students learn in this content area. Instructional and assessment strategies are considered as important components of teachers' "pedagogical content knowledge" (Gess-Newsome & Lederman, 1999; Shepard, 2001). In particular, in physics education research, it was argued (Boudreaux, Shaffer, Heron & McDermott, 2008) that teachers should be prepared for how to teach experiments and develop scientific practices in secondary school students. The same research team recommended that there is a need to develop "special courses" for physics teachers' preparation, since teachers need to know more and deeper than their students.

The present paper focuses on the pre-service physics teachers' efforts to learn how to assess student performance in the laboratory. The following three research questions guided the study:

1) What difficulties do the pre-service teachers experience when they develop learning objectives related to laboratory work?

2) What are the experiences of the pre-service teachers when they learn to assess in the laboratory? What assessment methods and laboratory activities do they develop?

3) What feedback do they give to actual secondary students' laboratory reports?

Before proceeding to the research methodology section**,** we present the conceptual and theoretical framework of the study.

Conceptual and Theoretical Framework of the Study

The study has adopted the American Association of Physics Teachers' (AAPT) approach, according to which, the aim is, through laboratory work, students to be able to design experiments, develop technical and practical skills, carry out investigations and learn how to write laboratory reports. According to the AAPT Report for the undergraduate physics laboratory, the aim is, through experiments, students to learn how different measurement procedures result in different uncertainties, design improvements to measurements, learn to break down components of experimental design, design experiments to test assumptions and understand limitations of measurement instruments (AAPT, 2014). Table 1 shows some of the laboratory skills included when one performs a physics experiment.

Table 1 Laboratory skills related to physics experiments

Laboratory skills
To plan an experiment: i.e., how to design a fair test.
To take decisions about the number of measurements (how many), how often measurements of the dependent variable need to be taken, range of measurements, how many trials are needed.
To draw an estimated best-fit line to the plotted data.
To draw an estimated best-fit curve to the plotted data.
To analyze the experimental data.
Analysis of precision and accuracy.
To identify outliers and sources of random errors.
To identify systematic errors and sources of systematic errors.
Students are able to talk about the results (in general) of the experiment.
Students are able to explain the results by using theory.
To determine slopes by using data from the graph (s).
To be able to check the reliability of data.
To perform calculations with data.
To make interpolation or extrapolation from data.
To evaluate the quality of experimental measurements, the procedure and the whole experiment.

It has been argued that one cannot assess laboratory skills by paper-and-pencil tests and multiple-choice tests because they are not adequate (Hofstein & Lunetta, 1982; Shavelson *et al.*, 1991; Shavelson *et al.*, 1993; Shavelson *et al.*, 1997; Solano-Flores *et al.*, 1999). Because of the complexity of performance in the laboratory, there are certain aspects that cannot be assessed by paper-and-pencil tasks. In simple terms, multiple-choice tests cannot measure students' ability to design an experiment, to analyze and interpret data. Thus, Shavelson *et al.* (1993) argued that assessment by paper-and-pencil methods give misleading and invalid information about how well students perform in the laboratory. Hofstein and Lunetta (1982) found that there is a low correlation between laboratory based practical examination and written paper-and-pencil tests. Shavelson *et al.* (1997) reached the same conclusion since they found that there is a moderate correlation (0.46) between hands-on performance and assessment of laboratory skills with paper-and-pencil tasks.

On the other hand, there are arguments which often focus on the use of multiple-choice items to assess laboratory skills (Miller *et al.*, 2013). The main idea in favour of multiple-choice items is that such items can be easily used for summative assessment since they are not time-consuming. Secondly, multiple-choice items can guarantee reliability of marking.

We need to emphasize that paper-and-pencil tests are adequate to assess only some aspects of laboratory skills. For example, the teacher may give a written test to ask his/her students to evaluate a set of experimental measurements by looking at the average value, the range and the likely outliers. Furthermore, a set of different assessment tasks will need to be developed to assess various skills. Different tasks assess different laboratory skills. On the other hand, if the teacher wants to assess how students perform an experiment, he/she should ask them to design and conduct the experiment. Also, it may be the case that students perform the whole experiment or a laboratory activity focused on specific skills. In addition, since it is necessary to assess students' writing skills and how coherently students present ideas in the laboratory report, one has to give more importance and value to the teacher assessment of laboratory work.

The focus of concern is then validity rather than reliability and easy administration of tests (Wiliam, 2003). Lazarowitz and Tamir (1994), in their review of assessment of laboratory work, extensively reported on the lack of valid and usable tools to assess students' achievement and progress in science laboratories. In addition, many teachers lack experience of assessment methods aiming to assess students in the science laboratory (Yung, 2001). As a result, in many cases, students' final grades do not include a component that directly reflects their performance in laboratory work and their understanding of that work. Thus, it is always possible that students do not perceive the practical work to be an important component of science learning.

Russell and Airasian (2012) defined performance assessment as follows: "*Performance assessment is a general term used to describe assessments that require students to demonstrate skills and knowledge by producing a formal product or performance. Performance assessment is often described as an alternative to timed tests that employ multiple-choice and short-answer items…Performance assessments generally require students to work on a product or prepare for a performance over an extended period of time… The product or performance often requires students to demonstrate the achievement of multiple objectives simultaneously*" (p. 201). According to this definition, the emphasis should be on students carrying out the whole experiment, even if it is a simple laboratory task. And vice versa, the experimenter should practice particular laboratory skills and then, he/she should be able to design an experiment and perform the whole experiment from the design phase up to the evaluation.

Teachers should be skilful in assessing labratory skills and, in more general, students' performance in the laboratory (Brown & Shavelson, 1996). In addition, a research study by Cameron *et al.* (2009) reported on the benefits of teachers' learning and professional development when the pre-service teachers look at actual student work and reflect on students' performance. Along the same thread, Herbel-Eisenman and Phillips (2005) provided strong evidence that by examining students' actual work, pre- and in-service teachers have the opportunity to learn about students' thinking and practices.

The various studies included in the reviews by Hofstein and Lunetta (1982; 2004) revealed that teachers may conduct experiments without clear purposes and goals. In addition, they pointed to the fact that there is usually a mismatch between teachers' goals for learning in the science laboratory and those that were originally defined by curriculum developers. Furthermore, Hofstein and Lunetta (1982) made the point that assessment of student learning outcomes may be inconsistent with stated goals of the teaching. In addition, as Séré (2002) suggested, each specific laboratory activity should have only a few and specific teaching goals and laboratory skills to address. The laboratory activities should, then, match curriculum and assessment goals.

We want to argue that there should be an alignment among curriculum, instruction and assessment goals, if we want to promote the development of laboratory skills. That is, the teacher should decide on some learning objectives, according to the curriculum. He/she, then, needs to prepare adequate laboratory activities or whole experiments to promote the development of such laboratory skills. Then, the assessment goals should be aligned with the learning objectives and teaching goals. That is, the assessment of laboratory work needs to be consistent with the proposed learning outcomes. In other words, assessment practices should be aligned with the goal of developing a few and specific laboratory skills. Thus, assessment is seen as an integral part of teaching and learning. For Wiggins (1992), good teaching is inseparable from good assessment.

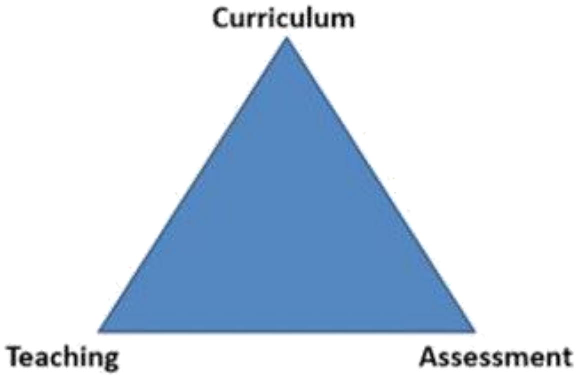

Figure 1. The alignment among curriculum, teaching and assessment.

We want to take the above point further to argue that the teacher should communicate the specific learning objectives to students, which need to be related to specific laboratory skills. Subsequently, teachers should develop the teaching and assessment tasks by themselves, so that they address the specific laboratory skills they intend to develop in students.

Campbell (2013) concluded, in her review of research on teacher competency in classroom assessment that novice teachers have relatively few experiences with a variety of assessment strategies. The same conclusion was reached by Black (1993; 1995), who conducted research to investigate teachers' assessment strategies. Both Campbell (2013) and Black (1993; 1995) argued that research investigating preservice teachers' assessment strategies during initial education is important to shed light on what needs to improve in their pre-service teacher education. There is also more recent evidence that beginning teachers can master some advanced skills in teaching and assessment practice, if they are supported by appropriate mentors (Wilson, Scweingruber & Nielsen, 2015).

The contribution of the present study is two-fold: Firstly, the participants learnt to develop performance assessment practices to capture complex laboratory skills developed in secondary school students. Therefore, performance assessment is practiced in a specific area of the physics teaching program, that of physics laboratory teaching. Secondly, the study was conducted within the area of physics teacher education. Thus, the implications will be closely related to the physics teaching program and physics teacher education.

Research Methodology

The reported study is a part of a bigger research project (Gkioka, 2019), which aimed to explore pre-service physics teachers' understandings of experimental procedure. And secondly, to investigate pre-service physics teachers' efforts to learn to teach and assess students' performance in the laboratory. Pre-service physics teachers were introduced to research-based teaching and assessment strategies for laboratory work. The focus of this paper is on the assessment component of the bigger project.

The context of the study

The research was conducted in the context of an undergraduate laboratory course specifically designed for pre-service physics teachers. In our department, an initiative was taken to prepare our pre-service teachers to assess secondary students' performance in the school physics laboratory. In particular, the aim was pre-service physics teachers to learn about performance assessment, to develop related learning objectives, laboratory activities and assessment goals and finally, give written feedback to secondary student laboratory reports for improvement. The study took place within the context of a compulsory course named "Secondary Science Laboratory Applications" in a Department of Physics Teaching. According to the program of our Physics Teaching Department, "pre-service teachers need to be able to design and implement research-based laboratory activities that will enable students to develop experimental skills." And, "pre-service physics teachers need to develop and apply assessment tools appropriate to the class and student level and use the results as a basis for decisions regarding student learning and teaching." (unpublished reference).

The content of the course included the performance of experiments in the laboratory, among which were Ohm's law, the insulation experiment, the simple pendulum motion experiment, Hookes' law (stretching), electromagnetic induction, motion on an inclined plane, free fall experiment, reflection and refraction and Boyle's law experiment. The topics of the experiments were kept according to the national science curriculum in Turkey (MEB, 2018). Based on the experience with laboratory in the physics department, the registered students needed to plan and conduct the experiment, analyze experimental evidence and write the laboratory report.

A second component of the course was: introduction to the role of experiments in physics learning, preparation of lesson plans, learn how to match laboratory activities with teaching goals, and finally, learn how to teach laboratory classes and assess student performance. Particular components of the assessment were: the development of assessment goals, the development of assessment criteria, development of rubrics and feedback in the laboratory reports (Brookhart, 2008). They learnt how to teach secondary students to write the laboratory report. Finally, pre-service teachers were also introduced to safety rules for the laboratory.

The participants

The participants were the registered students for the compulsory laboratory course called "Secondary school science laboratory applications" for one academic term. 36 pre-service teachers participated who were in the third or fourth year of their study. The course was offered in a public university in Istanbul, with English as official language. The 36 participants in laboratory classes were distributed in six different semesters during three years (six students in each term). Thus, no selection or other changes were made to the students who registered for the course and then, participated in the study. Hence, the study included purposive or purposeful sampling method, "based on the assumption that the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned" (Stake, 1995). Prior to the course, all of them had completed four undergraduate compulsory laboratory courses in the physics department. Two project assistants helped with data collection and analysis. The principal investigator was the instructor of the course.

Research design

A qualitative case study approach was taken (Stake, 1995; Yin, 2003). Data were collected in the context of the course (as described above) over one academic. The small number of participants (six) over one academic term facilitated the collaboration between the instructor and the pre-service teachers, as well as the collaboration among the participants. "A qualitative case study seeks to describe the topic in depth and detail, holistically and in context" (Stake, 1995).

Qualitative methods provide "rich" and detailed data that capture participants' attempts and difficulties when developing learning objectives, laboratory activities and assessment goals and methods for the laboratory. From a case study perspective, there is a need to triangulate data through the use of multiple data sources: by semi-structured interviews, participants' answers to exam questions, collection of the teaching and assessment materials developed by the participants and, collection of feedback. Russell and Martin (2007) in reviewing research on science teacher education, explained that methodologically, research on learning to teach and assess science, has used mainly qualitative research methods. In particular, the data sources were the following:

1) Collection of the learning goals (related to laboratory skills), as developed by the participants. They participants used them in microteaching to their peers.

2) Collection of the assessment materials and tasks that the pre-service teachers developed (focused on the development of laboratory skills), of all handouts and worksheets to look at their understanding and learning during the term.

3) Semi-structured individual interviews were conducted with teachers at different times, particularly during their preparation for teaching and assessment of laboratory activities and afterwards. The task-based interviews were effective in revealing the participants' difficulties and challenges related to the assessment of laboratory work. All interviews were audio-taped and transcribed for analysis. Examples of interview questions are shown in the Appendix A. The interviews were conducted with informed consent and by following the university research ethics committee protocols. Attention was given to the research ethics (Gregory, 2003) and the associated issues (anonymity of participants and the role of the researcher). The project assistants transcribed the recorded interviews. The development of the protocol interviews were grounded in the literature. Content validity of the interview protocol was achieved through review by one senior faculty member, who was expert in both assessment and research methodology.

4) Collection of written feedback that the pre-service teachers gave to actual laboratory reports. This is because research studies gave much importance on teachers' ability to give constructive feedback so that learners understand what they need to do in order to improve their written work (Wiliam & Leahy, 2015).

5) Participants' answers to exam (mid- and final-term) questions. The exam questions, developed by the principal researcher, aimed to elicit such difficulties and challenges (i.e., Tasks 1-2).

All pre-service teachers' names were taken out so that they were analyzed anonymously. Instead, numbers were added to facilitate the analysis and presentation of results. In addition, all participants' written consent to participate in the research study was asked for, at the registration time for the course. In the first lesson, the participants were given information about their committment to the research study.

Process of data analysis

The strategy for data analysis was suggested by Yin (2003). The theoretical orientation, which led to the study and shaped the data collection, served as the guiding strategy to focus on some of the data and ignore other irrelevant data. Content analysis helped to organize the collected data for the entire case study under the search for themes and patterns that shed light on the difficulties of the participants while they were learning to develop curriculum goals, assessment goals and methods related to laboratory skills (Miles & Huberman, 1994). Analysis is based on the triangulation of the sources of data (Robson, 2011). .

In presenting the results, we substantiate them with quotes from interviews, as well as with excerpts from the teaching and assessment materials and the laboratory activities which were developed by the participants. These excerpts are representative of the pre-service teachers' difficulties and experiences during the study. We also present examples of the tasks with which the participants were presented and worked on in the exams along with excerpts from the pre-service teachers' feedback on the laboratory reports. In the excerpts, the participants' language has been kept as submitted (no corrections were made by the researchers in terms of grammar and spelling in English language).

Results

The results of the study are presented under the following three main sub-headings in a way that each part corresponds to each research question separately.

1. Difficulties related to the development of learning objectives related to laboratory skills

Preparing to assess laboratory skills represented a great challenge for our participants. Thus, in the first weeks of the course, they did not feel confident to assess the laboratory skills and the corresponding learning objectives were weak. Their difficulty to write down the learning objectives related to the development of particular laboratory skills was clear. Tasks, like the following (Task 1 and Task 2 in Figures 2 and 3, correspondingly), were distributed in the class, as homework and in the exam papers. Such tasks were developed in order to help them develop the learning objectives closely related to the experimental skills.

Task 1: You, as a teacher
Write down some learning objectives to use when you teach planning (planning part) and taking measurements (obtaining evidence) skills in the free fall experiment.

Figure 2. Task related to the planning and obtaining evidence skills – learning objectives

In the first weeks, when working on the Task 1, the participants talked mainly about the theory involved without referring to the laboratory skills. Thus, they wrote that the topic was about free fall and described the motion of free fall and talked about the formulae. Similarly, when working on the Task 2 (Figure 3), they talked about the theory of insulation, heat and temperature, heat capacity and Newton's law.

Task 2: You, as a teacher
Write down some learning objectives to use when you teach the analysis of data and interpretation of data skills in the insulation experiment.

Figure 3. Task related to the analysis and interpretation data skills - learning objectives

During the first weeks of the course, they did not refer to the development of some laboratory skills. For example, the lesson objective was: "*By the end of the lesson, students will* *have understood the relation between the temperature of hot water and time*". Similarly, "*Students will be able to identify and determine the difference between heat and temperature"*. And, for the insulation experiment: "*Students will learn what an insulator is". "Understand how insulators work*". It is clear that they confused the theory of each experiment with the laboratory skills to be developed in their secondary students.

From the fourth week onwards, they talked about the preliminary experiment and the class discussion, in which, secondary students work in groups. Or, they talked about the discussion that may be initiated by the instructor about the design of the experiment, the variables and the planning of a controlled ('fair') experiment. Thus, in each experiment, they would think about the variables involved, how to design the free fall and insulation experiments as 'fair' tests. More specifically, they developed many learning objectives like: "*Use instruments to take measurements of temperature". "Carry out a controlled experiment"*. Other teaching goals and learning objectives were: "*Students will be able to draw a best fit line/ best fit curve". And, "use the best fit curve in the analysis and interpretation of data"* (for Task 2).

Through practice and by time they were able to articulate many curriculum goals and learning objectives. For example, they wrote teaching goals and learning objectives related to planning and designing "fair" tests.

"*Students learn how to plan the free fall experiment".*

"How to take measurements while performing the experiment".
"In the preliminary experiment, they will make decisions about how they will take measurements, how many measurements are needed and over which range".
"Students to be able to plan the insulation experiment, to identify the variables involved, to carry out the preliminary experiment and to design a controlled experiment".
"Teach to judge the range of measurements they need to take, when and why these need to be repeated, and how to deal with anomalous or discrepant results".
"Teach students to examine evidence for validity and reliability by considering questions of accuracy, error and discrepancy".
"Teach students how to draw the best fit line or best fit curve".
"Teach how to use the graph in the analysis of results".
"Teach how to write the laboratory report, particularly the analysis and interpretation of data by using theory".
"How to design a fair test", "How to collect and record data".
"How to analyze data", "How to make a detailed analysis of results by using the plotted graph and make the calculation of slopes".

All the above learning objectives and the ones below show learning objectives addressing the development of laboratory skills.

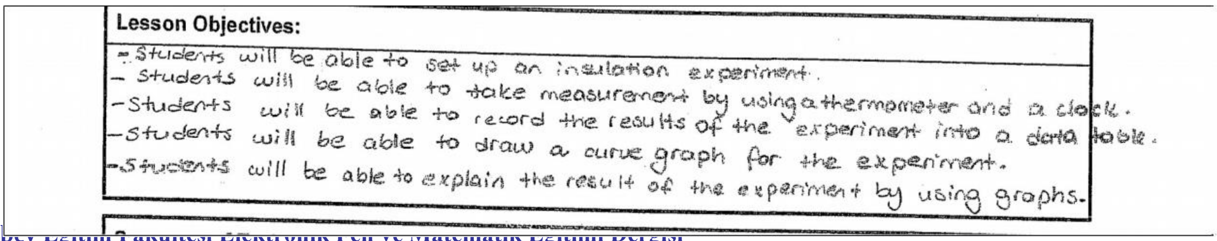
Lesson Objectives:
- Students will be able to set up an insulation experiment.
- Students will be able to take measurement by using a thermometer and a clock.
- Students will be able to record the results of the experiment into a data table.
- Students will be able to draw a curve graph for the experiment.
- Students will be able to explain the result of the experiment by using graphs.

Figure 4. Learning objectives related to the teaching of the insulation experiment (pre-service teacher 13)

In their turn, pre-service teachers prepared teaching materials, including laboratory activities and whole experiments. The following is an example of a task, which, one pre-service teacher developed to teach secondary school students about the reliability of experimental measurements.

Task 3: Ideal gas law

A group of students would like to investigate the dependence of volume of an ideal gas to its temperature. To do this, they kept all the other variables (except volume and temperature) constant. They increased the temperature by 10 C each step and they then measured the volume of the gas. Their data is shown in the data table below. (Ideal gas law is given as: PV = nRT, units of the variables are: P: Pascal, V: m^3).

Data Set

Temperature (Celsius)	Volume (m^3x10-6)
10	105.2
20	210.1
30	304.8
40	400.6
50	516.3

Is this data set reliable?

Figure 5. Task developed by one participant about reliability and quality of experimental measurements (pre-service teacher 27).

2. Experiences related to assessment methods, laboratory activities and assessment goals related to laboratory skills

Laboratory activities, like the Task 4 and Task 5, were distributed in the class, as homework and in the exam papers. Such tasks were developed in order to help them develop assessment methods and goals closely related to experimental skills.

Task 4: You, as a teacher

Write down some assessment goals to use when you assess your students' planning (planning part) and taking measurements (obtaining evidence) skills in the free fall experiment.

Figure 6. Task related to assessment goals (developed and delivered by the instructor).

Task 5: The insulation experiment

You, as a physics teacher

Investigating how the temperature of hot water falls down in three similar cans each wrapped with three different insulating materials.

I would like you to think how (with which assessment methods) you will assess students' laboratory skills related to analysis and interpretation of data in the above experiment.

What will be your assessment goals?

What makes a good analysis and interpretation of experimental results?

Figure 7. Task related to assessment methods and goals (analysis and interpretation of results skills) given in a final term exam (developed and delivered by the instructor).

Initially, the participants experienced difficulties in writing assessment goals and developing assessment tasks related to the development of laboratory skills. Again, their tasks were around the assessment of theory and content knowledge (free fall motion, heat and temperature and so on). However, during the course, they improved by developing assessment tasks like the one, which is shown in Figure 8. In addition, they shared assessment materials and tasks. Thus, they developed written tests (particularly end-of-unit tests) and homework. They also organized brainstorming sessions and they said that they assess students' understanding by the questions they pose to students or by the questions that students themselves raise during lessons. As the participants gained more and more experience in writing learning objectives related to laboratory activities, they became more independent and advanced their level of understanding of assessment in relation to laboratory skills. The following Task 6 (Figure 8) was developed by one pre-service teacher to assess his students' understanding of precision and accuracy in experimental measurements.

Task 6: Accuracy and precision
For Istanbul it is known that g = 9.8 m/s^2 . According to the table below, which data set is accurate, precise or both?

Data set 1	Data set 2	Data set 3	Data set 4
9.7	7.2	6.4	4.5
9.9	6.9	6.6	5.9
9.6	8.8	6.3	8.1
9.8	11.5	6.5	6.2
9.5	15.1	6.7	10.1
Average: 9.7	Average: 9.9	Average: 6.5	Average: 6.8

Figure 8. Task about accuracy and precision (pre-service teacher 18)

More importantly, they developed a range of assessment tasks in order to assess how their students design and perform a whole experiment, thereby, they practiced performance assessment (Task 7). Pre-service teachers talked extensively about the transition from using and developing multiple-choice tasks to performance assessment. Such transition represented the most severe challenges, because the participants were familiar with and confident in using only multiple-choice tests.

Task 7: Design an experiment to calculate the acceleration (g) by studying the simple pendulum motion.

Figure 9. Performance assessment (student 21)

Furthermore, they developed a set of rubrics for the performance assessment and for grading the written laboratory report (Figure 9). In this way, they experienced performance assessment and they matched learning objectives with assessment goals. Apart from developing assessment goals, they also developed rubrics for grading.

	Analysis and Explanation of Experimental Results		
3	The analysis of experimental results is very detailed and is done by referring to experimental data.	Reasonable conclusions are reached based on experimental results.	The rationale behind the explanations made about experimental results is given explicitly.
2	The analysis of experimental results is detailed and there is no referring to experimental data.	Conclusions are reached, but there is not enough reference to experimental results.	The rationale behind the explanations made about experimental results is given.
1	The analysis of experimental results is not detailed and there is no referring to experimental data.	Conclusions are related to other aspects of the topic under question.	The rationale behind the explanations made about experimental results is not clear.
0	The analysis of experimental results is not done.	There is no conclusion reached.	The rationale is not given for explanations made about experimental results.

Figure 10. Rubrics they developed and used to grade laboratory reports (pre-service teacher 4)

In the above set of rubrics, it is clear that the participants learned about the assessment criteria and also they communicated the assessment criteria in microteaching in the laboratory. They developed rubrics for assessing the application of laboratory skills aligned to the learning objectives addressed in the experiments. The participants understood that the rubrics must be well designed to facilitate learning. The rubrics were designed to be used for learning as well as for giving feedback and grades. Pre-service teachers learned how to use the rubrics they designed in microteaching. More importantly, they understood that the rubrics should be based on the learning objectives and the assessment criteria set by the teacher. From this perspective, the rubrics are not used to judge performance but to describe performance. Thus, they also used them when giving written feedback to secondary students' laboratory reports in order to communicate the intended quality to their peers. One student, after micro-teaching, explained in an interview: "*Developing assessment tasks was difficult for me. I needed some guidance. I keep the theory simple, so that I teach them laboratory skills. I learned about assessment goals and assessment criteria"* (student 4). And another one: "*This course made me feel more confident about assessment in the laboratory and developing rubrics*" (student 12).

It is worth underlining that through such practice, they reflected on it and expressed their needs: *"This course improved my content knowledge, assessment practice and further my knowledge about assessment. But, I feel that I still focus on the theory of the experiment and not on laboratory skills when I prepare assessment materials".*

The following section discusses their experience with feedback to laboratory reports.

3. The feedback they gave to actual secondary students' laboratory reports

The participants were asked to give feedback to secondary student laboratory reports. The reports were actual reports taken from secondary schools, provided by the researcher. Figure 11 shows a question from a final exam.

Task 8: You, giving feedback as a teacher
Give your written feedback to a secondary school student (Grade 11) who submitted the attached laboratory report (report is attached to the exam paper).

Figure 11. Exam question asking the participants to give feedback on a laboratory report.

When giving feedback, the participants wrote comments about what was good, what was not good and hence, what needed to be done for improvement. In the first weeks, it turned out that they had many difficulties because they were not confident about what a report should include and how it should be written. This may have been because in the physics laboratory, they were not writing full reports but they were answering some written questions (asking for calculations, for plotting graphs and so on). Thus, before them giving written feedback, a few classes took place with information about the four different sections of a laboratory report (design and plan, obtaining evidence, analysis and interpretation of results, evaluation of the experiment). The process of them giving feedback, helped the participants as they tried to figure out what the report should have included. Quite soon they gave comments which they wrote in the laboratory reports. For example:

"*You need to draw a graph and use it".*
"You need to collect better data / results so that you draw a better graph and be able to look at the pattern".
"Theory is missing" or, "You need to improve your theory".
"You need to describe your method. What are the variables involved in your experiment?" "Nice description of the procedure".
"The fair test is OK, but more measurements are needed".
"The data table is good enough".
"Why this number of measurements?"
"Variables (depended and independent) are missing".
"Points are plotted properly".
"What does the graph tell you about the whole pattern?" "Analysis is missing. What are the different rates of cooling?"
"You need to write a statement about the relationship between the two variables" and, *"You need to give the graph a title".*

The process of giving feedback helped pre-service teachers develop a good understanding of the quality of a laboratory report and what is included in each section. For example, they learned that in the analysis of results, one should judge the quality of measurements, use the graph to judge the quality, compare the prediction with the collected evidence, identify likely outliers and finally interpret the evidence by using scientific theory.

Secondly, such a process helped them make the transition from pre-service teacher (undergraduate student) to a practicing teacher. They reported that they enjoyed giving feedback. It was a process through which they learned firstly, how to improve the quality of their own laboratory reports and subsequently, how to give feedback to help their secondary students improve their work.

Figure 12. The interaction between giving feedback to student laboratory reports and improvement of laboratory reports

More importantly, through that process the participants should think about the learning objectives, the assessment criteria and assessment goals. In microteaching, they made clear to their peers (in micro-teaching) where secondary students were in relation to the intended outcomes, where they would need to go and how to get there (Wiliam, 2010). Thus, the feedback was focused on the task and learning targets and it was delivered in a way that was supportive and aligned with the learner's progress (Wiliam, 2010).

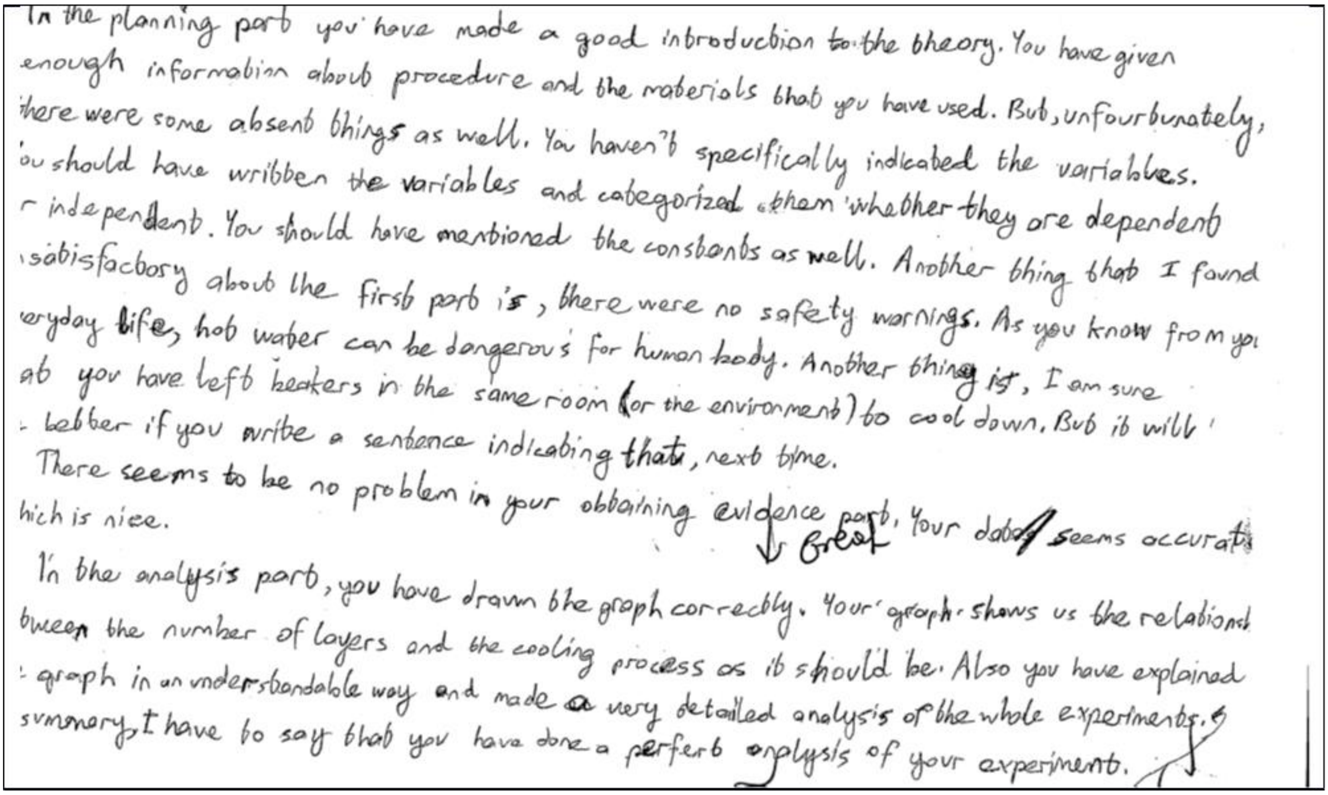
In the planning part you have made a good introduction to the theory. You have given
enough information about procedure and the materials that you have used. But, unfourtunately,
there were some absent things as well. You haven't specifically indicated the variables.
ou should have written the variables and categorized them whether they are dependent
r independent. You should have mentioned the constants as well. Another thing that I found
satisfactory about the first part is, there were no safety warnings. As you know from yo
eryday life, hot water can be dangerous for human body. Another thing is, I am sure
at you have left beakers in the same room (or the environment) to cool down. But it will
better if you write a sentence indicating that, next time.
There seems to be no problem in your obtaining evidence part. Your data seems accurat
hich is nice.
Great
In the analysis part, you have drawn the graph correctly. Your graph shows us the relationsh
tween the number of layers and the cooling process as it should be. Also you have explained
graph in an understandable way and made a very detailed analysis of the whole experiments.
summary, I have to say that you have done a perfect analysis of your experiment.

Figure 13. Written feedback (by a partcipant pre-service physics teacher) to a secondary student's laboratory report (pre-service teacher 25).

The teacher gave comments which were specific to the content that was expected and focused on the different sections of a laboratory report (design of the experiment, collection of measurements, analysis, explanation and evaluation of the procedure). The comments were clear and points were made for thought and improvement.

Discussion

What do the findings presented here mean in light of the need for preparing pre-service teachers to assess in the laboratory? The presented study provided evidence about the difficulties and experiences of our participants when learning to assess in the school laboratory. The aim was to document the pre-service physics teachers' efforts to learn to assess experiments and laboratory skills. The findings from this study support the idea that pre-service physics teachers experienced some difficulties when they learnt to develop a range of assessment methods, including performance assessment.

The study revealed a lack of knowledge closely related to the assessment, in general and then, in relation to the assessment of laboratory skills. Pre-service teachers had difficulties in connecting what they learnt with assessment practice. Most participants have had difficulties in writing assessment goals about how to assess a "fair" test or about how to analyze and interpret experimental results and so on. The participant pre-service teachers experienced difficulties in writing relevant learning objectives and developing assessment tasks. It would need around the first three weeks of one academic term so that our participants to be successful in developing learning goals related to the laboratory skills and assessing student performance in microteaching. Their difficulties may be explained due to the fact that they had different teaching experiences prior to joining the research study.

The process of providing written feedback to actual secondary students' laboratory reports turned out to be a real learning process. In fact, they learned about the quality of laboratory reports and what comments they need to write to help secondary students improve them. They also developed assessment criteria and rubrics for grading the laboratory reports. Our findings are consistent with evidence from recent studies which showed that this process helped pre-service teachers improve their own laboratory reports (Herbel-Eisenman & Phillips, 2005; Cameron *et al.*, 2009). The presented research also confirmed one of the conclusions drawn by Zeichner and Conklin (2005), who argued that the major goals of teacher education research is to stimulate and deepen learning and to promote changes in teaching practice.

In addition, this study elicited new findings. The pre-service teachers experienced considerable challenges when attempting to develop performance assessment; thereby moving beyond multiple-choice and paper-and-pencil tasks. They also showed satisfaction with the development of learning goals beyond conceptual knowledge and their use in microteaching. Finally, they were satisfied with working towards the alignment of learning goals with teaching and assessment, by learning about the development and implementation of appropriate assessment methods. However, the participants need to gain more confidence in teaching and assessing in the laboratory. Pre-service teachers need to develop a commitment to continue learning to assess.

The argument that is put forward by this study, is that teachers need time and practice to get prepared to develop learning objectives, as well as laboratory activities. The teacher should initially select some learning objectives. Making, then, an appropriate design and using laboratory activities to develop a few and specific laboratory skills is not an easy task. The use of commercial laboratory manuals does little to improve this situation because they present "cookbook" activities demanding little thinking and reflection on the part of students. Thus, we want to argue in favour of a "less is more" approach to focus on a few laboratory skills for each activity to promote specific and a few important learning outcomes. To promote the development of selected laboratory skills, teachers need to be competent at developing their own tasks and performance assessments. Towards such a direction, pre-service teachers need to be able to develop an array of learning goals related to experimental skills, as well as a broad range of teaching materials and assessment tasks. Of course, no one would doubt that teaching schemes are invaluable guides for newly qualified or inexperienced teachers. Teachers need appropriate books and materials developed for them but also time and opportunities to develop their own materials. It is neccessary that teachers develop teaching and assessment tasks by themselves, so that they address the specific laboratory skills they select to develop in secondary students.

Like Hofstein and Lunetta (2004), we believe that: "inconsistencies between teachers' goals and behaviours and limitations in teachers' skills, in this case in the school laboratory, should be addressed carefully in long-term professional development programs designed to develop the understanding, knowledge and skills of professional teachers" (Hofstein & Lunetta, 2004, p. 45). There should be courses so that pre-service teachers have more opportunities to develop curriculum and assessment goals about laboratory skills. We need to discuss what subject knowledge and assessment knowledge are essential for teacher preparation to teach and assess in the school laboratory. Such a discussion will be the first step to ensure that assessment preparation promotes the development of appropriate assessment tasks and student learning.

Conclusions and Implications

The study has, firstly, implications for the science curriculum and assessment practice. When talking about teaching physics, we should include laboratory work, too. Not only should we consider what our goals and aims are in relation to the teaching in the laboratory, but also include issues about the assessment of laboratory skills. We should rethink the role of and practice in school laboratory. We should develop specific curriculum goals closely related to the development of laboratory skills for each level in secondary schools. Then, the curriculum should discuss how (with which assessment methods) performance in the laboratory needs to be assessed. We would like to add that the university entrance exams must be aligned with the curriculum goals which include experiments and laboratory activities. Then, teaching should include laboratory classes and performance assessment in order to achieve alignment among curriculum, instruction and assessment. In order to include laboratory experiments in the university entrance exams, we need to take ideas from other countries like the UK, Germany and France, which have a long tradition in large-scale performance assessment (e.g., Cullinane, Erduran & Wooding, 2019).

Secondly, the study has implications for physics teacher education. Pre-service teachers need to develop confidence in developing assessment goals and methods related to laboratory skills. They need practice in giving feedback to laboratory reports and to coursework. These research findings offer strong support for the need of the development of special courses for the preparation of physics teachers. Pre-service physics students need more opportunities to practice the assessment of laboratory skills. An adequate preparation of physics teachers is vital to ensuring that pre-service teachers will be confident in teaching and assessing laboratory skills. For example, the issue of how to prepare pre-service teachers to become skilful in assessing student performance in the laboratory should be an important component of teacher education programs so that laboratory work receives more importance in secondary education in Turkey. Teachers have to set clear goals for students' learning outcomes which have to be consistent with the assessment goals. This pre-supposes that we give much value to the role and the value of the teacher; that we trust his/her professional judgement on the basis of assessment. As Roth (2007) argued, we need teacher research which supports teacher learning. Towards this direction, pre-service teacher education and later, teacher professional development is crucial in helping teachers to become more effective in developing and implementing appropriate assessment strategies. As Anderson (2000) stated: “We need to develop teacher education programs that promote the qualities of practice that we value” (p. 294).

In research terms, the small number of six participants over one term enhanced the close support and collaboration with the instructor and among the participants. Pre-service teachers’ learning was observed continuously as they progressed during the course and over the period of one academic term. It is one of the strengths of the research design, since it has allowed the collection of rich data in detail. However, having taken a case study approach, we should not fall into the trap to argue that more cases lead to greater generazibility or external validity (Stake, 1995; Yin, 2003). We would like to invite similar case studies in departments with pre-service physics teachers to identify pre-service physics teachers’ difficulties and successes in other countries and contexts.

Thirdly, it is not realistic to expect that such a preparation and practice is enough. More time would be necessary for more practice. Indeed, pre-service teachers need longer practice, as well as support during the first years of their teaching in schools. One academic term is of limited time, especially if one considers the depth and complexity of the issues studied. It is worth extending the period of one academic term to follow the same participants in their first years of teaching. Acknowledging these limitations, we should note that the current research is not an evaluation of the course for physics teacher preparation. In fact, the aim was not to collect evidence to improve the program of teacher education. This study, nevertheless, provides data on pre- service physics teachers’ efforts to learn to assess in the physics laboratory. If we want to promote laboratory work in secondary school physics, we need to work towards the development of performance assessment in pre-service physics teachers.

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Appendix A

Interview questions

Tell me how you develop your learning objectives for teaching in the laboratory.
Why do you teach this experiment?
What laboratory skills you want to develop?
How do you assess experiments in the laboratory?
What laboratory skills will you teach in this investigation(s)?
How will you find out how well teaching goals have been achieved?
How will you know what students have achieved (learned)?
Do you let your students how you will assess their work?
What are your priorities when you give feedback?
What assessment tasks do you like to develop and use?
Are there some cases that you change the lesson plan that you already prepared?
Do you make any use of assessment results for further planning and teaching?