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Examination of Special Field Competencies of Pre-Service Science Teachers in Online Courses

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Abstract

The study aimed to determine the level of planning and organizing the learning and teaching process, one of the special field competencies of pre-service science teachers in online environments in science courses. A qualitative research approach was used in this study, which tried to determine the special field competencies of the 4th-grade pre-service science teachers of Recep Tayyip Erdogan University Faculty of Education who applied for the Teaching Practice courses online during the pandemic process. In this research, the special case method was used. The "Planning and organizing the learning and teaching process" dimension, one of the special field competencies, was examined through lesson observations, and the data was supported through interviews. The data collection process took place over five months between February and June 2021 and was completed by observing 60 hours of six pre-service science teachers working with two different mentor teachers and an average of 50 minutes of interviews with each of them. As a result of the research, teacher candidates mainly were at A0, A1, and A2 in the dimension of organizing learning environments in line with the curriculum in the teaching process, at A1, A0 proficiency level in the sub-dimension of being able to plan the teaching process by the curriculum, and at A1 proficiency level in the sub-dimension of being able to use materials and resources that support the curriculum in the teaching process has been determined.

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Introduction

The Turkish education system aims to ensure the construction of a society that will consist of individuals surrounded by social values, reflect ethnic structures by the modern age, combine knowledge with technology, and have 21st-century skills. The most critical task in this process falls on teachers, the primary education practitioners. Many opinions have been put forward about the professional values and competencies of both teachers and pre-service science teachers, and they have been discussed in many dimensions (Aydin, 2010; Babacan & Sasmaz Oren, 2015; Karabacak et al., 2015, 2018; Kurnaz, 2019; Ozturk-Bilgin, 2022). Today, education changes occur more intensely and faster than in all periods of history. This situation makes it necessary to approach the "teaching" profession from a multidimensional perspective (MNE, 2017). When the research is considered, the result shows that the quality of education is directly related to the quality of the teacher (Babacan & Sasmaz Oren, 2015; Fidan, 2012; Kurnaz, 2019). In this context, when the studies on teacher training are examined, it is seen that the problems related to this subject are primarily solved in a quantitative sense, and today, quality problems come to the fore, and essential and concrete steps have been taken in this regard (Tugluk & Kurtmen, 2018). For this purpose, first, six main competencies, 31 sub-competences, and 233 performance indicators were determined by the General Directorate of Teacher Training and Education within the Turkish Ministry of National Education to obtain the critical support of all stakeholders (primary education inspectors, education faculties, teachers, non-governmental organizations) and the "Teaching Profession General Competence Draft" been prepared for discussion (TEDP, 2006). It was decided that it would be the most appropriate method to determine these general competencies of the teaching profession in the form of main competencies, sub-competences of the main competencies, and performance indicators of these sub-competencies, and it was accepted that teacher competencies should cover not only knowledge but also skills and attitudes. This structuring has been tried to give weight to practice and theoretical knowledge in teacher training and gain skills in this direction.

As a continuation of the studies, the Turkish Ministry of National Education determined 16 special field competencies in 2008 to show the development targets in various dimensions for branch teachers at the primary education level, and within this framework, special field competencies were also determined for science teachers (see MNE, 2008). They were organized under the title of "Competence Fields" and grouped as "Scope" and "Competences." The Ministry of National Education (MNE) has created 'Performance Indicators' by categorizing different educational actions as A1 (knowledge and awareness), A2 (enrichment), and A3 (customization and collaborative work). Performance indicators are based on curricula.

A1 level: It includes the performance indicators showing the teacher's awareness of the practices related to the curriculum and the basic knowledge, skills, and attitudes that he/she has regarding the teaching profession. A2 level: In addition to the knowledge and awareness of the teacher at the A1 level, it includes the performance indicators that the teacher fulfills the requirements of the program, diversifies its applications, and considers the interests and needs of the students with the professional experience gained in the teaching process. A3 level: It includes performance indicators that require the teacher to diversify the arguments developed uniquely in line with the needs of the students, considering the different variables of the teaching. Having performance indicators at this level, the teacher can contribute to the field with original new practices and collaborate continuously with colleagues, parents, non-governmental organizations, and other institutions. A3 performance level includes A2 and A1 levels, while A2 performance level includes A1. Although the A3 level of performance

indicators is shown as the highest level, it is not the upper limit of development (MNE, 2008, p.42). The levels are not aimed at classifying teachers or limiting them to school and environmental conditions but to help the teacher adopt the principles of continuity and lifelong learning in his individual professional development, to make it easier for him to realize his current situation while making his self-evaluation, and to make use of the opportunities of the environment at the highest level to increase the quality of education and training arranged for.

Science Teaching Special Area Competencies consist of 24 competencies in five competency areas and 132 competency indicators related to these competencies. Performance indicators are considered a roadmap for providing professional development by showing improvement goals rather than evaluating teachers (MNE, 2008). It is seen that there is a comprehensive framework of competency items determined by the MNE as a standard. It can be predicted that teachers with these competencies will increase the country's education quality.

The most recent update on teacher competencies was made in 2017 and shared under the "teaching profession general competencies" guide. These consist of three primary competencies: professional knowledge, professional skills, attitudes, and values; 11 sub-competencies under these three main competencies; and 65 performance indicators for each sub-competence (see MNE, 2017).

Considering that the teaching profession is considered a field that requires special specialized knowledge and skills, the pre-service training process must be of the expected quality so that teachers can acquire these competencies (Numanoglu & Bayir, 2009). In this regard, there is a remarkable consensus that to increase the quality of teachers, it is necessary to be sensitive while providing field, field training and educational formation to the pre-service science teachers in the pre-service period to increase teaching practices and to design the content of the courses to be sufficient for the candidate when he/she graduates. In the continuation of this process, also in the in-service period. To gain these competencies, necessary research should be done (Isik et al., 2010; Ozturk-Bilgin, 2022; Tugluk & Kurtmen, 2018).

Considering that all kinds of interventions to be made through education and training for individuals forming the society can gain meaning through the hands of teachers, who are the main stakeholders in the implementing position, teachers directly impact the process (MNE, 2017). In this context, in addition to theoretical studies on determining teacher competencies, it is also necessary to examine the extent to which teachers and pre-service science teachers have these competencies. In the related literature, in addition to the studies that directly concern the special field competencies of science teachers (Aydin, 2010; Candas, 2016; Ergun et al., 2013; Fidan, 2012; Sungur-Gul & Ozer-Ozkan, 2013), the special field competencies of teacher candidates are also examined. There are a limited number of studies examining the relationship between education and learning styles (Koroglu & Sivaci, 2017) and comparing the overlap levels of learning outcomes of science teaching undergraduate program courses prepared within the scope of the Bologna Process with specific field competencies (Ozyurt et al., 2017). In only one of them (Ergun et al., 2013), pre-service teachers' views regarding acquiring special field competencies in science and technology in teacher training programs were evaluated. Similarly, in another study, a table was created to be used to compare the learning outcomes of the undergraduate program's field and field education courses with the special field sub-competencies, and it was predicted which special field

competencies could be gained by the pre-service science teachers if the learning outputs were realized as planned (Ozyurt et al., 2017).

According to Karatas (2020), teachers must be trained in line with teacher competencies in the pre-service period. One of the most critical stages of the teacher training process is that pre-service science teachers practice in natural educational environments, and observing the performances of pre-service science teachers at this stage is essential for the later stages of education. Pre-service science teachers can find this opportunity in school experience and teaching practice courses. A teaching practice course is planned so that the teacher candidate can try to develop the knowledge and skills he has acquired in a school environment and gain the competencies required by his profession (Saritas, 2007). This course aims to ensure that teacher pre-service science teachers, in addition to presenting their theoretical knowledge and professional skills in natural classroom environments, can get to know the organizational structure, management, and functioning of the school, students, and teaching with a systematic approach. During this process, they could try to develop their teaching skills and undertake all the responsibilities of the teaching profession for a while, and they can observe and practice at different class levels. Feedback, support, and guidance are given to prospective teachers in this process, and their professional needs are tried to be met (Cepni et al., 2005). In short, the teaching practice course is one of the environments where the extent to which pre-service science teachers have the competencies in question can be examined. In the study, the lessons of pre-service science teachers were observed within the scope of 'The Teaching Practice-II' course, and their special field competencies, "Planning and Organizing the Learning-Teaching Process," were examined. In practice, online lessons for prospective teachers were observed due to the pandemic process in the country.

In this sense, the study aims to determine the level of the " Planning and organizing the learning and teaching process " dimension, one of the special field competencies of pre-service science teachers in online environments in the science course.

Method

A qualitative research approach was used in this study, which tried to determine the special field competencies of the 4th-grade pre-service science teachers of Recep Tayyip Erdoğan University Faculty of Education who applied for the Teaching Practice courses online during the COVID-19 pandemic process. Qualitative studies investigate social phenomena in their environment, have a holistic approach, are participants, and have flexibility (Creswell, 2013; Yildirim & Simsek, 2008; Kucuk & Sevim, 2022). The special case method, one of the qualitative research methods, was used in the research. The case study allows the researcher to focus on a particular case or event, define the different factors in the study in detail, and explain the cause-effect relationships between the variables (Cepni et al., 2005). In addition, the case study allows the researcher to use various data collection methods such as observation, interview, and questionnaire.

This research used the special case method because pre-service science teachers' "Teaching Practice" course studies were examined in detail. The "Planning and organizing the learning and teaching process" dimension, one of the special field competencies, was examined through lesson observations, and the data was supported through interviews. The data collection took place over five months between February and June 2021. A total of ten hours of lesson observations were made for each of the six pre-service science teachers with two different mentor teachers (60 lesson hours total). A semi-structured interview of approximately 50 minutes was also conducted with each of the six pre-service science teachers.

Data Collection & Analysis

Observation Forms

The studies carried out by pre-service science teachers within the scope of the 'MB400 Teaching Practice II' course they took in the spring semester of the 2020-2021 academic year were observed in this research. The first researcher made observations by attending the pre-service science teachers' online lessons that lasted for a semester at the practice school. In these lessons, pre-service science teachers prepare lesson plans for the achievements in the science curriculum and teach the lessons with online lessons. Sixty online lessons from pre-service science teachers were observed. Online lessons consisted of approximately 30 minutes. The observer observed the pre-service science teachers ' online course presentations through the observation form and took notes. The observation form is an observation chart used by the faculty within the scope of the course, which consists of four parts: planning, teaching process, classroom management, and communication in planning and organizing the learning-teaching process (see MNE, 2019).

The researcher also participated in the communication groups (WhatsApp, Google Classroom) created with the pre-service science teachers, mentor teachers, and the mentor instructor at the faculty (second researcher) and examined the feedback and corrections to the lesson plans. In addition, the researcher participated in the evaluation meetings of the mentor instructor, mentor teacher, and pre-service science teachers after the lessons.

The descriptive analysis method was used to analyze the data. This method seeks answers to research questions with the data obtained (Sigri, 2018). In this context, the performance indicators of the A1, A2, and A3 levels determined for each competency in the Science Special Field Competency guide published by the Ministry of National Education were used as the conceptual framework. A new level (A0) was created for the statements that could not be assigned to any of these levels among the answers given. From the observation data obtained, the behaviors of pre-service science teachers were classified according to A0, A1, A2, and A3 performance competency levels (Performance competencies are explained in detail in the introduction section). Pre-service science teachers' behavior and competency levels are presented in a table.

Semi-Structured Interview Forms

After the pre-service teachers' observations were completed, semi-structured interviews were conducted with the pre-service teachers to support the observations. Semi-structured interviews were conducted with six pre-service science teachers.

Interviews by the researcher were conducted online by determining suitable periods for the pre-service teachers and were recorded by obtaining permission from the participants. Interview questions were prepared with the help of experts based on the ability to plan and organize the learning-teaching process according to the curriculum. Interview data includes three main questions and auxiliary questions within the scope of "planning the instruction," "organizing the instructional environment," and "use of materials and resources supporting the instructional environment." Each interview took an average of 50 minutes.

While the data obtained from the interviews were analyzed, the researcher wrote down the video recordings. To ensure the confidentiality of the participants, the pre-service teachers who contributed to the study were coded as PT1 (pre-service teacher 1), PT2…PT6. Unrelated statements were removed from the answers given to the interview questions by the pre-service science teachers. The answers of them were classified by creating codes under the categories created under the themes of "planning the instruction," "organizing the instructional

environment," and "use of materials and resources that support the instructional environment." Coding was done by the researcher and an expert. Interview texts were read and coded many times. The related codes were arranged, the data obtained by categorizing according to the intended competencies levels (A0, A1, A2, A3 levels) were tabulated, and examples from the statements of the pre-service teachers were presented. Examples of how the pre-service science teachers' statements and researcher observations are categorized are given below.

Table 1

Interview and Observation Analysis Example

Competencies levels	Statement of the pre-service science teacher	Pre-service science teacher codes
A1: It includes performance indicators that show the teacher's awareness of his/her practices regarding the curriculum and his/her basic knowledge, skills, and attitudes regarding the teaching profession.	*Science process skills were unavailable in the courses at the 8th-grade level. Attendance was not practical because they were final-year exams. I spent more time-solving questions.*	PT1

PT: Pre-service science teacher

Results

In this part of the research, the data collected with the determined measurement tools were analyzed, and the analysis results of the interview data and lesson observation data collected for the science special field competencies of the teacher of pre-service science teachers, which were clearly associated with the performance indicators under separate headings, were visualized in tables and graphs.

Lesson Observations Results

Six pre-service teachers' teaching and learning processes were observed for 60 lesson hours. From the observation data obtained, the behaviors of the pre-service teachers were classified according to A0, A1, A2, and A3 levels. The lessons observed were coded as L1 (Lesson 1), L2, L3, L4,..L9, L10. The proficiency and levels obtained from the observations are presented in Table 2.

Table 2

Proficiency Levels Developed from Lesson Observations

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	Sub-competencies
PT1	A2	A2	A1	A1	A2	A2	A2	A2	A2	A2	Planning the Teaching Process by the
PT2	A2	A2	A1	A2	A2	A2	A2	A1	A2	A2	Curriculum
PT3	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	
PT4	A1	A1	A1	A1	A0	A1	A2	A2	A2	A2	
PT5	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2	
PT6	A1	A1	A1	A1	A2	A2	A2	A2	A2	A2	
PT1	A2	A2	A1	A1	A1	A1	A2	A2	A1	A2	
PT2	A1	A1	A1	A2	A1	A1	A0	A2	A2	A2	Being able to organize learning
PT3	A1	A1	A2	A2	A1	A2	A2	A2	A2	A2	environments in line with the
PT4	A1	A1	A1	A1	A0	A1	A1	A1	A1	A2	curriculum in the teaching process

PT5	A1	A0	A1	A0	A1	A1	A1	A1	A2	A2	
PT6	A1	A0	A1	A1	A2	A1	A1	A2	A1	A2	
PT1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	
PT2	A1	A1	A1	A1	A1	A1	A0	A1	A1	A1	Ability to Use Materials and
PT3	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2	Resources Supporting the
PT4	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	Curriculum in the Teaching Process
PT5	A1	A0	A1	A1	A1	A1	A1	A2	A2	A2	
PT6	A1	A0	A1	A1	A1	A1	A1	A2	A1	A2	

PT: Pre-service science teacher; L: lesson

Table 2 shows for the sub-dimension of being able to plan the teaching process in line with the teaching plan that pre-service science teachers showed one behavior at the A0 performance level, 18 at the A1 level, 42 at the A2 level, and no behavior at the A3 level. In the sub-dimension of organizing learning environments in line with the curriculum in the learning process, pre-service teachers showed five behaviors at A0 performance level, 32 behaviors at A1 level, and 22 behaviors at A2 level, while none at A3 level. In the sub-dimension of using the materials and resources that support the curriculum in the teaching process, the pre-service teachers showed three behaviors at the A0 performance level, 48 behaviors at the A1 level, nine behaviors at the A2 level, and none at the A3 level (Table 2).

Interview Results

The data obtained from the semi-structured interviews conducted with six pre-service science teachers were classified according to the A0, A1, A2, and A3 levels of the sub-competencies "instructional planning," "organizing the teaching environment", "use of materials and resources that support the teaching environment" and are presented in Table 3.

Table 3

Proficiency Levels Developed from Semi-Structured Interviews

Sub-competencies	A0	A1	A2	A3	Example expression
Planning the Teaching Process by the Curriculum	PT2 PT5 PT6 PT4	PT2 PT1	PT3		(PT2) The teacher should be active in the lessons. For example, students understand the subject less when they study it independently, even if the subject is taught; they know it better with the teacher's explanation (A0). (PT1) Science process skills were not available in the courses at the 8th-grade level of secondary school. Attendance was not adequate because they were final-year exams. I spent more time solving questions (A1). (PT3) I thought about the introductory lessons with many possibilities that might attract the students' attention according to the outcome (A2).
Being able to organize learning environments in line with the curriculum in the teaching process	PT2 PT6	PT5 PT4 PT3	PT6	PT5 PT1	(PT6) We generally proceed with the narrative method; I try to reinforce what I discuss in the presentation with some visuals. Children understand better this way (A0). (PT4) Evaluation challenged me the most while preparing the lesson plan. Since there are online courses, there are

					Quizz and Kahoot, but I used multiple choice and fill-in-the-blank presentations in more presentations (A1). (PT6) …some concentrate on one activity, while others focus on another. Some have visual intelligence, and some of them are more auditory. I pay attention to these (A2). (PT1) Unfortunately, we have an exam-oriented education system, which is critical guidance. We may have similar ability-determining exams like PISA (A3).
Ability to Use Materials and Resources Supporting the Curriculum in the Teaching Process	PT4 PT1 PT2	PT1 PT3 PT5 PT6	PT5	PT3	(PT1) I have my own style of expression. The student should learn by doing and experience and should be involved in learning, so I designed materials to be recyclable in every lesson (A0). (PT6) I used EBA most frequently. The most appropriate expression suitable for their level is in EBA (A1). (PT3) EBA is reasonably sufficient and a good application. There are games and practical things suitable for students' levels (A1). (PT5) I used EBA to watch videos and have virtual experiments (A2). (PT3) I tried to enter each of my friends' lectures. Because in this way, I got to know the students better and saw different expressions. I noted the missing points. To avoid making mistakes in this regard (A3).

Table 3 shows in the sub-dimension of planning the teaching process by the curriculum that pre-service teachers with the codes PT2 and PT6 gave answers at the A0 level, while PT3, PT4, and PT5 answered at the A1 level, PT6 at the A2 level, and PT1 and PT5 at the A3 level. In the sub-dimension of organizing learning environments in line with the curriculum in the teaching process, while no answers were found at the A3 level from the pre-service teachers, it was seen that PT1 gave A1, PT2's A0 and A1, PT3's A2, PT4's and PT5's A0 level answers. In the sub-dimension of using the materials and resources that support the curriculum in the teaching process, it was seen that PT1 generally gave A0 and A1, PT2 A0, PT3 A1, PT4 A0, PT5 and PT6 A1 level answers. However, PT3's answers at the A3 level were also found.

Discussion

In the research conducted to determine the level of "planning and organizing the learning-teaching process" dimension, one of the special field competencies of pre-service science teachers in online environments in the science course, when Table 2 regarding the lesson observations is examined, it is seen that the performance indicators are concentrated at the A2 proficiency level. In the interviews, it was determined that the answers given by the pre-service science teachers regarding the 15 performance indicators in the dimension of planning and organizing the learning-teaching process supported the observations and that there were mostly A1 and A2 proficiency levels and a small number of performance indicators at the A3 level (Table 3). Some studies in the literature support this result of the research. Ergun

et al. (2013), Babacan and Sasmaz Oren (2015), and Ozturk-Bilgin (2022) obtained similar proficiency-level results in the dimension of planning and organizing the learning-teaching process, one of the special field competencies in their studies with various methods and samples. The interviews with the teacher pre-service science teachers determined that they mainly focused on the lecture method and question solution in which the teacher was active in their lessons. Pre-service teachers who prepare lesson plans according to the 5E model of constructivist learning theory are expected to include activities that will enable students to achieve achievements through activities in which they are active in the discovery phase of their lesson plans. At this stage, the teacher acts as a guide. Afterward, in the explanation phase, activities are organized to allow students to explain the activities they did in the previous phase. Afterward, the teacher proceeds to the next stage by explaining. These pre-service teachers' statements and practices show deficiencies in applying constructivist learning theory. Similar results were also found in the study of Ayvaci and Er Nas (2009). As a matter of fact, in the study conducted by Metin and Ozmen (2009), it is stated that pre-service teachers have difficulties in finding exciting experiments in the discovery phase, and it is thought that the problem arises from the fact that the pre-service teachers do not conduct detailed research on the learning outcomes. Another reason may be that although they took theoretical courses on constructivist learning theory and applications in many different undergraduate courses, they could not reach the learning outcomes in the applied courses in the faculty. As a matter of fact, Tekbiyik and Akdeniz (2008) and Kukut, 2021 also stated in their study that although the curricula based on the constructivist theory are in effect, teachers have difficulties in understanding the principles of this theory and in classroom practices. In general, the findings obtained from the data collection tools show that prospective teachers have deficiencies in applying constructivist learning theory. Constructivist learning theory was put into practice with the change made in the curriculum in 2005, and subsequently, this subject began to be taught theoretically and practically in many different courses (Science learning and teaching approaches, Science Teaching I and II, Science teaching laboratory applications I and II) in undergraduate teacher education courses. However, it is thought-provoking that such negative results were obtained regarding applying constructivist learning theory in this study conducted in 2021.

When the observations made on the performance indicators of the sub-dimension of organizing learning environments in line with the curriculum of the learning process of the pre-service science teachers are examined, it is seen that there are agglomerations at A1 proficiency level and A0 proficiency level when the interviews are examined (Tables 2 and 3). When the observations about the lessons of the pre-service teachers are examined, they generally use the lecture method, and they do not organize activities for the student's prior knowledge or misconceptions. They also have deficiencies in their subject knowledge; there are deficiencies in giving feedback to the students in the lesson, they cannot use their tones effectively, and they cannot use the tones of their voices effectively. It was determined that the incomplete screenshots caused the communication to be incomplete. For all these reasons, it has been observed that students are usually interested in different activities (taking care of pets, listening to lessons while lying down) and that they are bored with the lessons. In the interviews with the teacher pre-service science teachers, PT2 stated that the teacher should be active in the lessons. Other pre-service teachers should have used new methods and techniques in their lessons, citing different reasons (unsuitable for learning outcomes, teaching lessons with 8th graders, etc.) (see Table 3). Cepni et al. (2005) found similar statements in their interviews. This situation shows that despite the changes and updates in the curriculum in

different years, the pre-service teachers needed help to adopt the curriculum requirements and had difficulties applying them. The deficiencies of pre-service science teachers in educational innovations in knowledge and skills prevent the curriculum from reaching its goals. For the prepared curricula to be successful in practice, pre-service teachers should be trained by the constructivist approach. These findings show that pre-service teachers need teaching methods and techniques and are unsuccessful in managing the learning process. In the constructivist approach, the teacher's role in ensuring that learning can take place is to help students correct their pre-knowledge misconceptions and eliminate their missing information to construct the information and organize the learning environment in line with the needs of the students. In this sense, pre-service science teachers should be able to use different methods and techniques. However, the abovementioned situation shows that pre-service science teachers need help to achieve the learning outcomes of some courses the faculty takes (Teaching Principles and Methods, Science Learning and Teaching Approaches).

When Table 2, which is prepared for teacher pre-service science teachers' observations, is examined, it is seen that there is an accumulation at the A1 proficiency level regarding the performance indicators in the third sub-dimension of pre-service science teachers, which is the ability to use materials and resources that support the curriculum. It has been determined that pre-service teachers generally use presentations in their lessons (ppt. extension). They frequently use the Ministry of Naitonal Education portal called EBA (Education Informatics Network), which is used to support presentations, and they benefit from YouTube in some of their lessons. In detailed lesson observations, it was determined that they included too many texts in their presentations (PT3). They had Kahoot, Classtools, Story Boardthat, and Word Wall tools, which are web 2.0 tools, in the evaluation part, but they could not use them effectively (such as deficiencies in giving feedback to students) (PT3, PT4, PT6). The data in the pre-service teachers' interviews and course observations support each other, and it has been learned that the pre-service teachers generally benefit from EBA in their lessons. However, they stated that they had difficulties in the technical use of EBA at the beginning of the process (logging into the system, accessing the activities, using the EBA observation form) and needed to learn of some issues. This shows that pre-service teachers need to improve the materials that will enrich their lessons and how to use them effectively. Although some tried to use Web 2.0 tools in their lessons, they were unsuccessful. However, if pre-service teachers are familiar with developing/using these materials and resources that will enrich their learning environment, enable students to be active in the lessons, and increase their interest and motivation towards the lesson, it will make their professional life more manageable. Even if the teaching materials are modern and prepared by technology, teachers need to use them effectively to be successful at the expected level. When course materials are used in a timely and qualified manner, it provides information transfer and helps the information be more permanent. Hu et al. (2003) stated that teachers in schools are resistant to instructional technologies and attributed this to the pre-service training of teachers. Studies on teachers' use of instructional technologies and materials show significant problems. Ucar (1998), in his research, concluded that teachers know the importance of using teaching materials, but they need to be made aware of the changing technology, and their use of materials is low. Instructional technologies and materials play an essential role in fulfilling the teaching function of the teacher and in being effective in the students' learning process. It is undeniable that identifying teachers' problems regarding the use of teaching materials and increasing the solution options will significantly contribute to the quality of teaching.

Limitation & Suggestion

The following suggestions can be made for the education faculties and researchers responsible for training pre-service science teachers who are expected to gain special field competencies in science.

1. After receiving theoretical knowledge in undergraduate courses, changes and plans can be made for constructivist learning theory to be carried out in natural classroom environments outside the faculty.
2. An elective course besides the course in instructional technologies in the undergraduate program for using Web 2.0 tools can be added.
3. This study examined the dimension of planning and organizing the learning-teaching process according to the curriculum. Detailed studies can be made for other dimensions.
4. Opportunities can be provided for pre-service science teachers to develop more lesson plans using different methods and techniques in undergraduate education.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

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