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Evaluation of the Training to Make Preservice Science Teachers Use Web 2.0 Tools during Teaching*

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Abstract

This study examines the effect of a training program on pre-service teachers' ability to design materials using Web 2.0 tools by applying training to pre-service science teachers to use Web 2.0 tools. In the research, a holistic single case study method was used. Semi-structured interviews, "Teachers' Digital Teaching Material Development Self-Efficacy Scale" and document analysis were used as data collection tools. The sample of the research consists of 16 pre-service science teachers studying in the Science teaching program of the Faculty of Education of Recep Tayyip Erdogan University in the fall semester of the academic year 2021-2022. The "Teachers' Digital Teaching Material Development Self-Efficacy Scale" was applied to the pre-service teachers twice as a pre- and post-test. The training for the teaching of Web 2.0 tools was completed during a total of 25 40-minute lessons outside of the participants' class hours and in three weeks. At the end of the study, improved teaching Web 2.0 tools for education, pre-service teachers teaching material that has a positive impact on developing digital competencies, to increase their awareness of Web 2.0 tools for use in the learning process, it provides enough about to be able to use Web 2.0 tools to start to see and realize the importance of the concept of Web 2.0 tools in teaching that the use is concluded. In accordance with these results, in order to use the Web 2.0 tools for research, pre-service teachers, elective courses in undergraduate programs, etc. the proposals have been terminated.

Keywords: Preservice science teachers, science education, Web 2.0 tools

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Introduction

A good teacher is a person who fulfills their duty under all conditions (Erişen & Şen, 2002). In this context, teachers have an important place in raising individuals who research and question, perceive and adopt all kinds of changes, try to reach the source of information, and keep up with technology. In order to achieve this, they naturally need to have various competencies (Küçük & Küçük, 2020). In this process, the competencies expected of science lessons and teachers, which are directly related to students' lives and include many concepts and information that students should have in order to solve the problematic situations they encounter in their daily lives, are of great importantance. It is necessary for science teachers to have sufficient knowledge of contemporary learning-teaching strategies and to apply them in the best way in learning environments (Akpınar & Ergin, 2005; Bakırcı, Çepni & Ayvacı, 2015; Düşkün & Ünal, 2015; Hancer, Şensoy & Yıldırım, 2003; Küçük, 2006; Özmen, 2004). Considering that our age is the age of technology and students' interest and intense use of technology, it will be inevitable for teachers to benefit from technological tools in this process. It is stated that in the science curriculum the development of scientific knowledge and the use of technological tools such as computers in the implementation of this process facilitate science teaching. Additionally, it is expected that appropriate course material should be prepared by integrating technology regarding the achievements in the program and teachers are expected to have digital competence in this sense (MEB, 2018). These expectations are also seen in the 2023 Education Vision document published by the Ministry of National Education. In this publication, there is a section called digital content and skillful transformation in learning processes. Some of the prominent features at this point are,

- Creating a digital education and training content development ecosystem
- Creating a national digital content archive,
- Training of leading teachers who develop digital learning materials,
- Developing tools for measuring and evaluating learning environments and materials,
- Expanding the use of digital materials as main materials,
- Developing new generation digital assessment materials that support metacognitive skills so that students can get the desired results in international exams such as PISA (MEB, 2018).

While this situation regarding the digital competence of teachers was emphasized in 2018, the pandemic and distance education process that took place in our country and in the world in 2019 revealed that our teachers actually have deficiencies in this regard (Çakın & Külekçi Akyavuz, 2020; Sertkaya Dinler & Dündar, 2019; Temiz, 2021). The main reason why teachers experience these deficiencies may be their lack of in preparing digital content and digital material during the pre-vocational education process. There are also studies in the literature regarding this situation

(Sarıtepeci, Durak, & Seferoğlu, 2016; Usluel, Mumcu, & Demiraslan, 2007). The fact that the pandemic process lasted for about two years also had positive effects on teachers in using technology (Bakioğlu & Çevik, 2020; Sertkaya Dinler & Dündar, 2019). The compulsory use of technology has led teachers to do research on this subject and has enabled them to meet many new technologies. In this process, one of the technologies that will facilitate the work of teachers is Web 2.0 tools. With Web 2.0, individuals can communicate socially and transfer information to each other, the transferred information can be recorded and information can be accessed more quickly. In Web 2.0, e-mail, phone applications, messaging over the web, etc. Thanks to the use of applications, XML, API, AJAX, RSS, blog, etc., technologies and applications have improved. As an example, some apps such as StoryboardThat, Mentimeter, Blendspace, Phet app, Infogram app, Oppia, Book Creator, KialoEdu, Canva, Creately, etc. can be given. It has been determined that the use of Web 2.0 tools in learning environments has a positive effect on students' actively producing content, acquiring and sharing information, collaborating with peers in the classroom, and increasing academic success, interest and motivation towards the course (Batıbay, 2019; Isaias, Miranda & Pifano, 2020; Onbaşılı, 2020; Özpınar, 2020; Weller, 2013). It is critical that the teachers to be using these tools in learning environments have sufficient knowledge and equipment. In this sense, the aim of the study is to examine the material development situations by using these tools after the training program developed for the teaching of Web 2.0 Tools for pre-service science teachers.

Method

In this study, a holistic single case study, one of the qualitative research designs, was used. In this design, an event is examined by the researcher at the place where the event occurred and it is used in cases where there are many evidence or data sources and the boundaries of the case cannot be drawn precisely in terms of content. By this way, the researcher seeks in-depth answers to the questions of why (Sığrı, 2018; Özmen & Karamustafaoğlu, 2019). In this study, researchers developed a training program for pre-service science teachers to teach Web 2.0 Tools. Along with this program, an in-depth analysis was made on the situation of pre-service teachers to get to know and use Web 2.0 tools, develop course materials using these tools subsequently and prepare course plans suitable for the developed course materials. It is known that document analysis, archive analysis, interview, focus group interview, direct observation, participant observation, etc. are used as data collection tools in such studies (Sığrı, 2018). In this context, "Teachers' Digital Teaching Material Development Self-Efficacy Scale", lesson plans prepared by pre-service teachers after the training, and semi-structured interviews were used as data collection tools in the research.

Study group

In the study, typical case sampling among the purposive sampling methods was used. Typical case sampling “requires determining a situation typical of many situations in the universe regarding

the research problem and collecting information from this sample" (Büyüköztürk et al., 2020). The study group consists of 16 pre-service science teachers (12 females and 4 males) studying in the second year of science teaching in the 2021-2022 academic year. Since the pre-service teachers in the study group took the "Information Technologies" course in the first two semesters, it was assumed that they had prior knowledge of computer usage skills and they were determined on a voluntary basis.

Data Collection Tools and Process

"Teachers' Digital Teaching Material Development Self-Efficacy Scale" , course plans prepared by pre-service teachers following the training, and semi-structured interviews were used as data collection tools in the research.

Teachers' Digital Teaching Material Development Self-Efficacy Scale

Within the scope of the research, the "Teachers' Digital Teaching Material Development Self-Efficacy Scale" developed by Korkmaz, Arıkaya and Altıntaş (2019) was used as a data collection tool. The scale consists of three sections. These sections consist of 38 items in total: Web 2.0 Development (15 items), Design (17 items), Negative view (6 items). The scale was applied to pre-service teachers as a pre-test before the training and then as a post-test after the training.

Course Plans

By using the Web 2.0 tools they learned after the Web 2.0 tools training, the pre-service science teachers developed course plans covering two-course hours for the achievements they determined from the science curriculum. Course plans were analyzed with the rating scale developed by the researchers. The Rating Scale is in a 3-point Likert format and consists of 21 items. In order to ensure the content validity of the Rating Scale, opinions were received from 5 faculty members who are experts in the field of science education. In line with expert opinions, the rating scale was finalized.

Semi-Structured Interview

Before the research, semi-structured interview questions were prepared as a draft. After the unstructured observations made during the implementation process, the interview questions were rearranged. The interview questions, consisting of five questions in total, were submitted to expert opinion, evaluated in terms of content validity, and given their final form. After the pre-service teachers presented their course plans in front of the experts, the course plans were classified into three groups as upper, middle, and lower levels in line with the opinions of the experts. Two people were selected from each of these groups and semi-structured interviews were conducted with six pre-service science teachers in total. Interviews were conducted with each pre-service teacher in

approximately 15 minutes. In order to prevent data loss during the process, all interviews were recorded via Google Meet with the permission of the participants.

Data Analysis

During the data analysis process, 16 pre-service science teachers were coded as T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15 and T16. The analyzing method of the data is presented below under separate headings.

"Teachers' Digital Teaching Material Development Self-Efficacy Scale" was applied to the participants twice as a pre- and post-test. SPSS 26 analysis application was used for the analysis of the obtained data. Wilcoxon Signed Rank Test was used to analyze the data.

Within the scope of the research, pre-service teachers were asked to determine the learning outcomes from the science curriculum and develop course plans by using the Web 2.0 tools they learned following the Web 2.0 tools training. Course plans were prepared in groups of two. The group members were formed by the pre-service science teachers themselves. In this context, a total of eight course plans were examined. While examining the course plans, the students were given a code number. The coding process was created by using the defined codes of the pre-service teachers in each group. For example, it was coded as Group 1 (T2-T8) to indicate that the first group consisted of the second and eighth pre-service teachers. Thus, a total of eight groups were formed, [G1(T2-T8), G2 (T9-T11), G3 (T4-T13), G4 (T1-T14), G5 (T5-T15), G6 (T3-T12), G7 (T10-T16) and G8 (T6-T7)]. In the analysis of the data, the developed "Rating Scale" was used. The obtained data were analyzed using thematic analysis (Braun & Clarke, 2006). The course materials developed by the pre-service science teachers were classified into three thematic areas and analyzed individually. These thematic areas are "Web 2.0 Tools Used in Materials", "Subject Areas Used in Materials" and "Topics Covered in Materials". A total of eight course plans developed by the pre-service science teachers as a group were analyzed and discussed simultaneously by the researchers, and a common decision was reached. The data obtained are included in the Findings section.

Content analysis was used to collect the data from the interviews. Interview data analysis process includes coding the data, finding the themes, arranging the codes and themes, creating the tables with the frequencies of the codes and themes.

Validity and reliability studies

In order to ensure reliability and validity in the study, the following studies were carried out:

- Data were collected with three different data collection tools. Thus, in the study, the data were compared with each other and examined whether they showed consistency.

- In order to prevent data loss during the semi-structured interview process conducted with pre-service science teachers, all interviews were conducted over Google Meet and the interviews were recorded with their permission.
- Expert opinions regarding the data collection tools to be used in the research were sought.
- Care was taken to be objective in the description and interpretation of the data.
- While interpreting the data, direct quotations were made from the views of pre-service science teachers.
- Evidence for how the research results were reached and the inferences made are presented clearly and in detail so that readers can understand the research process.
- The first researcher participated in TEDA 8 (Technology Supported Argumentation Training for Undergraduate Science Students) supported by TUBITAK, although he took the master's course named "Design of Technology Supported Learning Environments in Science Education" in order to carry out this research in a more qualified way. After participation, the researcher was given a certificate of participation by the event coordinator.
- In order to prevent data loss within the scope of the research and to ensure reliability in the analyzes carried out, the data analyses were carried out simultaneously by the researchers, however, they were repeated four times in different time periods.

Implementation Process

The implementation was carried out in the form of a training program consisting of a total of 25-40-minute lessons in three weeks, outside the course hours of the participants. The implementations were completed in the computer laboratory of Recep Tayyip Erdogan University, Faculty of Education. In the laboratory, there are computers with internet access that students can use individually, as well as an interactive board. In the table below, the activities carried out for practice in each training hour are given.

Table 1. Implementation process

Activity	Time (Minutes)	Content of the lesson	Detailed Lesson Content
Concept and misconception	40	What is the concept? What are misconceptions? What is the importance of detecting and eliminating misconceptions?	Concept definition, concept development processes, importance of concepts, misconceptions, importance of misconceptions in science teaching.
Web 2.0	40	Web 2.0, The historical process of the web	What is the web? What is Web 2.0? Web (1.0, 2.0, 3.0, 4.0) periods from past to present.
Concept cartoon	40+40	StoryboardThat	Concept cartoon, use of concept cartoon in science courses, concept cartoon development, StoryboardThat application.

Mentimeter	40	Mentimeter	Introducing the Mentimeter application, presenting an example and developing sample
Blendspace	40	Blendspace	Introducing the Blendspace application, presenting an example and developing sample material by the participants.
Phet ve Padlet	40+40	Phet application, POE method and Padlet application	Introducing the Phet simulation application, introducing the POE method, introducing the Padlet application, presenting an example and developing sample material by the participants.
Infogram	40+40	Infogram	Introducing the Infogram application, presenting an example and developing sample material by the participants.
Oppia	40+40	Oppia	Introducing the Oppia application, presenting an example and developing sample material by the participants.
Book Creator	40+40	Book Creator	Introducing the Book Creator application, presenting an example and developing sample material by the participants.
KialoEdu	40+40	KialoEdu	Introducing the KialoEdu application, presenting an example and developing sample material by the participants.
Newspaper, poster preparation	40+40	Canva	Introducing the Canva application, presenting an example and developing sample material by the participants.
Creately	40+40	Mind map and fishbone crafting with Creately	Introducing the Creately application, presenting an example and developing sample material by the participants.
Kahoot!	40+40	Kahoot	Introducing the Kahoot application, presenting an example and developing sample material by the participants.
Course Plan Preparation	40	Course plan development based on the 5E model	Introducing the 5E learning model, and developing course plans according to the 5E model using Web 2.0 tools learned by the participants during the training.
Presentations	60	Presenting the developed course plans to the experts	Presenting the developed course plans to the expert group, including two faculty members from the faculty of education and the researchers themselves, and giving certificates of appreciation to the pre-service science teachersfor their participation.

Findings

In this section, the findings obtained from the data collection tools are presented under separate headings.

Teachers' Digital Teaching Material Development Self-Efficacy Scale Pre-Test and Post-Test Findings

Within the scope of the research, the "Digital Teaching Material Development Self-Efficacy Scale of Teachers" was implemented to pre-service science teachers before the training process as a pre-test and then as a post-test. The obtained results were entered into the Microsoft Excel program.

SPSS 26 analysis application was used for the analysis of the data. The findings related to the descriptive analyzes are presented in Table 2.

Table 2. Descriptive statistics

Sample	n	Mean (X)	SD
Pre-test	16	126.12	18.90
Post-test	16	151.00	14.96

When Table 2 is examined, there is a difference between the mean scores of the pre-service teachers in the study group they got from the "Analysis of the Digital Teaching Material Development Self-Efficacy Scale of Teachers" administered before the implementation (X=126.12; SD=18.90) and the scores they got following the implementation (X=151.00; SD=14.96), an increase was observed in favor of the post-test. In order to examine whether this increase was significantly different, Wilcoxon signed-rank test analysis was performed on the scores they received from the questionnaire.

Table 3. Wilcoxon signed rank test

Pre- and post-test	N	Mean ranks	Sum ranks	z	p
Negative ranks	-	.00	.00	-3.409	.001
Pozitive ranks	15	8.00	120.00		
Zero	1				

*p<.05

According to the Wilcoxon signed rank test, this change in the scores of the pre-service teachers who participated in the implementation they got from the "Analysis of the Digital Teaching Material Development Self-Efficacy Scale of Teachers" is at a significant level (z=-3. 409, p<.05) and is in favor of the post-test.

Findings of Course Plans

The course plans developed by the pre-service teachers were analyzed with the developed grading scale and a table was created from the data obtained.

Table 4. Course plans rating scale

Item number	Item	Yes *f*	Partially *f*	No *f*
1	Appropriate font size is used.	4	1	3
2	Appropriate font is used.	6	1	1
3	Considering the principle of integrity, the related items are placed close and the unrelated items are far away.	5	1	2
4	It is designed in accordance with the developmental characteristics of the student.	8	-	-
5	While preparing the material, attention was paid to color harmony.	5	1	2
6	Appropriate images are used.	5	1	2
7	It is designed using contrasting colors between the background and shapes.	5	-	3
8	While developing the materials, content was developed in a (visually) interesting way in terms of density, color and alignment properties.	1	7	-
9	An appropriate title has been created.	8	-	-

10	It is designed in such a way that students can use it individually.	8	-	-
11	Understandable and simple language is used.	6	2	-
12	It is designed by considering the different learning styles of the student.	8	-	-
13	It is designed to develop students' communication skills.	7	1	-
14	It is designed to develop students' critical thinking skills.	7	-	1
15	While preparing the material, teacher needs were taken into account.	8	-	-
16	It is designed to allow students to peer learning (social learning).	7	-	1
17	It is designed in accordance with the objectives and outcomes of the curriculum.	-	-	8
18	The content is designed to reveal possible misconceptions about the determined outcomes.	5	1	2
19	It is designed to be accessible and available for use of every student.	7	-	1
20	It is economical.	8	-	-
21	The content is designed to allow students to associate science concepts with their daily lives.	8	-	-

When the course plans rating scale table is examined, it is seen that the course materials prepared by the pre-service science teachers have deficiencies in terms of design (1, 2, 3, 5, 6, 7, 8, 11). In addition, it was determined that pre-service teachers took into account the students' ability to use them individually, their learning styles and teacher needs while developing their course plans (10, 12, 13, 14, 15, 16). It is also seen in the table that the use of the developed material is functional (19, 20, 21).

The course materials developed by the pre-service science teachers were classified into three thematic areas and analyzed individually. These thematic areas are "Web 2.0 Tools Used in Materials", "Subject Areas Used in Materials" and "Topics Covered in Materials". Tables related to frequency distributions for these are presented below.

Table 5. Web 2.0 Tools Used in materials and their frequency distribution.

Web 2.0 Tools Used in Materials	*f*
Blendspace	5
Book Creator	8
Canva	3
Crealty	6
İnfogram	2
Kahoot	8
KialoEdu	1
Mentimeter	8
Padlet	7
Phet	6
StoryboardThat	6

When Table 5 is examined, the Web 2.0 tools used by the pre-service science teachers in the course materials they developed following the Web 2.0 tools training are mostly Kahoot (f:8), Mentimeter (f:8), Padlet (f:7), Creately (f:6), Phet (f:6) and StoryboardThat (f:6) applications.

Table 6. Subject areas used in materials and their frequency distribution

Subject Areas Used in Materials	*f*
Physics	2
Chemistry	3
Biology	1
Astronomy	2

When Table 6 is examined, it is determined that pre-service science teachers have chosen the subject areas in the sub-dimension of science in the course materials they have developed.

Table 7. Topics Covered in materials and their frequency distribution

Topics Covered in Materials	*f*
Acids and Bases	1
Earth, Sun and Moon	1
Electric circuits	1
Solar System and Beyond	1
Conductive and Insulating Materials	1
Heat and temperature	1
States of matter	1
Mitosis and Meiosis	1

When Table 7 is examined, it is seen that pre-service teachers have prepared course plans for different subjects from the subject areas of physics, chemistry, biology and astronomy.

Findings of Semi-Structured Interviews

In this section, the findings obtained from semi-structured interviews with six pre-service teachers are included to deepen the research results.

The frequency distribution of the opinions of pre-service science teachers regarding their answers to the question "What are Web 2.0 tools?" is given in Table 8.

Table 8. Web 2.0 tools

Web 2.0 Tools	*f*
Blendspace	3
Canva	3
Crealty	2
İnfogram	1
Kahoot	6
KialoEdu	1
Mentimeter	4
Oppia	2
Phet	1
StoryboardThat	2

When Table 8 is examined, the answer to the question “What are Web 2.0 Tools?” is mostly seen to be Kahoot (f:6), Mentimeter (f:4), Blendspace and Canva (f:3). T10 also said, “Web 2.0 tools

are a technological tool used in teaching the subject in the education process. For instance; I can give examples of applications such as Mentimeter, Blendspace, Canva, Infogram, Kahoot.”.

Their opinions on the question of "For what purposes can web 2.0 tools be used in science lessons?" are given in Table 9.

Table 9. Purposes of using web 2.0 tools

Purposes of Using Web 2.0 Tools	*f*
Individual Difference	1
Experiment/Simulation	2
Evaluation	2
Permanence	1
Embodying Concepts	2
Misconception Detection	1
Provide Easy Explanation	2
Student Interest and Attention	5
Enabling the student to discover information	1
Identifying preliminary information	2
Creative Thinking	1

When Table 9 is examined, it can be seen that pre-service science teachers use Web 2.0 tools to attract students' interest and attention (f:5), to develop experiments/simulations (f:2), to evaluate (f:2), to embody concepts (f:2) and to determine the students' preliminary information on the subject (f:2). Examples of pre-service teachers' statements; T10: “By appealing to students who have visual, verbal and auditory intelligence types, I increase their permanence on the subject. In addition, after the subject concepts are taught, I use it to determine the prior knowledge of the students in the evaluation of learning.” T14: “With the Mentimeter application, I reveal the students' prior knowledge and their thoughts about the concept, I prepare a concept cartoon from the StoryboardThat application and show it to be used in order to determine the misconceptions of the students and to evaluate the lesson process.”.

Before participating in this training program, pre-service science teachers were asked whether they had any anxiety, and their opinions are given in Table 10.

Table 10. Anxiety before education

Anxiety Before Education	*f*
Inability to Integrate into Science Lessons	2
Worry about not being able to	4
No Anxiety	1

When Table 10 is examined, it is seen that pre-service teachers have concerns such as not being able to perform the applications taught during the education process (f: 4) and not being able to integrate the Web 2.0 tools they have learned into science lessons (f: 1). Examples for the statements of pre-service teachers; T10: “Before the training, I had the fear of whether being able to learn Web

2.0 tools.", T5: "Before the training process, I had the fear of learning Web 2.0 tools and the anxiety of failing. ".

The pre-service science teachers were asked whether their concerns were resolved during the training, and if so, the reasons for this were asked and the data obtained are given in Table 11.

Table 11. Reasons for anxiety relief

Reasons for Anxiety Relief	f
Explanation From Simple to Complex	1
Interest and Attitude towards the Course	1
Having Sufficient Knowledge and Equipment of the Researcher Implementing the Program	5
The Positive Attitude of the Teacher	3
Easy access to the teacher	4
Reinforcement (Assignment, Presentation)	2
Positive Classroom Environment	1
Request to Learn New App	1

When Table 11 is examined, pre-service teachers are observed to state that providing access to the teacher whenever requested via Google Classroom, e-mail, Whatsapp, telephone communication in or out of the classroom (f:4), that the teacher has sufficient knowledge and equipment in teaching Web 2.0 tools. (f:5), the teacher's positive attitude in and out of the classroom (f:3), and the reinforcement of Web 2.0 tools (f:2) by giving weekly homework about the practices in the education process are effective in eliminating their anxiety. Examples of pre-service teachers' statements; "Before the training, I had the fear of whether being able to learn Web 2.0 tools. After the training, these concerns were resolved. The reason for relieving my anxiety; the fact that the teacher's style of expression was good during the education process showed us a positive, patient attitude towards us. During the education process, the teacher's mastery of the subject in the Web 2.0 tools described, the teacher's explanation in every level, and the explanation of the applications from simple to complex helped me to overcome my concerns."

The views of pre-service science teachers about the Web 2.0 tools they have found the most difficult with in the education process and the reasons for the difficulties are given in Table 12.

Table 12. The most difficult web 2.0 tool and cause of difficulty

The Web 2.0 Tool Difficult	***f***	**Cause of Difficulty**	***f***
Oppia	2	Foreign language	2
		Adding an Action	1
Phet	2	Lack of Computer Use	2
StoryboardThat	2		2

When Table 12 is examined, it is seen that the pre-service teachers have difficulty adding foreign language (f:2), action to the Web 2.0 tools that they have expressed as Oppia (f:2), Phet (f:2) and Storyboard That (f:2). f:1) and lack of computer use (f:4). Examples from the statements of

teacher candidates; T1: “The web 2.0 tool that I had the most difficulty with during the training was the Storyboard That application because it was very difficult for me to include push-and-hold commands in the application. The reason for this difficulty may be due to my lack of computer use.”, S5: “The application language that I had the most difficulty with during the education process was Storyboard That, even though the language of use was Turkish. I think the reason is my lack of computer use in enlarging-reducing, font and font size adjustment processes while preparing speech content.”

The views of pre-service science teachers about the Web 2.0 tools they enjoy the most during the education process are given in Table 13.

Table 13. Enjoyable web 2.0 tool

Enjoyable Web 2.0 Tool	***f***
Blendspace	1
Kahoot	1
Mentimeter	3
Oppia	1

When Table 13 is examined, it is seen that the answers of the pre-service science teachers to the question "What is the web 2.0 tool that you enjoyed most during the education process?" were as Mentimeter (f:3), Blendspace (f:1), Kahoot (f:1) and Oppia (f:1). Examples of pre-service teachers' statements; S16: “Oppia was the application that I enjoyed the most during the education process. Because, I liked the fact that it was made up of code blocks and that we determined the feedback to be given by the character in the application.”, T10: “The Web 2.0 tool I enjoyed the most during my training was the Blendspace application. Because, it offers features that will meet many needs of the teacher in the application. For example; pictures, videos, writing theoretical information about the subject, preparing evaluation questions.”.

Discussion and Conclusion

As a result of the analysis of the "Digital Teaching Material Development Self-Efficacy Scale of Teachers" applied to pre-service science teachersas a pre- and post-test within the scope of the research, it was determined that there was a significant difference in favor of the post-test (Table 3). This result can be considered as an indication that the Web 2.0 tools training carried out positively affects pre-service teachers' digital teaching material development. Onbaşılı (2020) have found similar results in their study. When the answers given by the pre-service teachers to the interviews are examined, it is seen that the education process increases the awareness of the students about the use of Web 2.0 tools in the learning process, and their own practice and material development makes them permanent in using Web 2.0 tools and helps them to see themselves as competent in this regard (Table 9, 11). These statements of the pre-service teachers show that the education applied has positive effects on having the desired features in the science curriculum. Similarly, Isaias, Miranda and Pifano

(2020) and Demirkan (2019) also have stated in their studies that the use of Web 2.0 tools in higher education is effective in factors such as technology selection, user-friendly tools, student participation, high number of active students, access to relevant content and communication.

One of the biggest advantages of using Web 2.0 tools in science courses is that they facilitate concept teaching. As a matter of fact, Can and Usta (2021) have concluded in their study that Web 2.0 supported concept cartoons facilitate student attention and learning in science courses. In their study, Pürbudak (2020) has determined that the use of Web 2.0 tools in science courses is effective in reinforcing the subjects and ensuring that learning is permanent. In the semi-structured interviews conducted in parallel with these results, it is seen that the pre-service science teachers stated that Web 2.0 tools can be used in science lessons to attract students' attention and attention (f:5), to develop experiment/simulation (f:2), for evaluation (f:2), for concretizing concepts (f:2), and determine students' prior knowledge about the subject (f:2) (Table. 9). These answers given by the pre-service teachers can be considered as an indication that they are aware of the importance of using Web 2.0 tools in concept teaching. The fact that pre-service science teachers have this awareness in the first years of their undergraduate education will motivate them to use these tools in their classes in their professional life. In the literature, there are studies showing that web-based education has many positive effects on learning-teaching processes; ; e.g., the use of Web 2.0 tools in physics teaching (Baig, 2011), a science teaching design prepared in the web environment (Bayrak Karadeniz & Bayram, 2012; Karagöz & Korkmaz 2015), science teaching supported by technology (Akgün et al., 2014; Demirkan, 2019), web-based science teaching prepared according to the multimedia design model (Çetin & Günay, 2010), adaptive educational web environments (Güngören Canan, 2019), computer-aided education software (Buluş Kırıkkaya et al., 2016), web-based science education (Can, 2008; Ercan, Bilen, & Bulut, 2013), a problem-based learning method supported by Web 2.0 tools (Hursen, 2020).

Pre-service science teachers claimed that they had difficulties in learning some Web 2.0 tools in Web 2.0 tools training and that the reason for this difficulty (Table. 12) was that the language of use of some of the Web 2.0 tools in the training was not Turkish and they had deficiencies in computer use. They stated that in order to overcome these difficulties, they should eliminate their deficiencies in foreign language and computer usage. Similar results have also been found in the study of Mertoğlu and Öztuna (2004). In this study conducted with pre-service science teachers, pre-service teachers stated that Turkish websites containing technology-supported teaching materials were hesitant to develop technology-assisted materials in the material development process due to insufficient computer usage skills and foreign language knowledge of pre-service teachers.

The greatest responsibility for the success in the teaching process belongs to the teacher. Before the teaching process, the teacher should plan the activities to be presented in the course,

effective teaching, effective communication, good classroom management, good guidance, tolerance, patience and understanding, etc. It is expected that the attitudes and behaviors of the students in the classroom will increase positively and their anxiety will decrease (Gültekin, 2020; Gül, 2004). During the education process given to the students within the scope of the research, they were in constant communication with the students. In the course, during the teaching of Web 2.0 tools by the researchers, the opportunity for pre-service teachers to practice was presented after each step of the process of the related web tool was shown. At this point, the researchers ensured progress by helping the pre-service teachers during the practice times provided to them, in the parts where they had difficulties, in the parts they had hesitations, and in the points they did not understand. Apart from the courses, the participation of pre-service science teachers in the class opened via Google Classroom was ensured. In addition, a Whatsapp group has been created. In this way, we were in constant communication with the pre-service science teachers after the courses. Regarding this process, the pre-service science teachers were asked, "What are the reasons for your anxiety following the training?". They stated that their concerns were resolved. They stated that the reason for this was due to the above-mentioned processes, as seen in Table 11. These answers given by the pre-service teachers show that the implementation process went well in their favor. This situation again revealed the importance of the teacher in the classroom, regardless of age group.

In summary, as a result of this research, it was concluded that the training developed for the teaching of Web 2.0 tools positively affected the pre-service teachers' competence in developing digital teaching materials; increased their awareness of the use of Web 2.0 tools in learning processes; their own application and material development work provides permanence in using Web 2.0 tools; it enables them to start to see themselves as sufficient in this regard; and they realized the importance of using Web 2.0 tools in concept teaching.

The aim of the study is to examine the material development status of pre-service science teachers using these tools after the training program developed for teaching Web 2.0 Tools. After the training, they have developed many materials that they can use in science teaching With Web 2.0, individuals can communicate socially, transfer information to each other, the transferred information can be recorded, and information can be accessed more quickly. During the pandemic we have been through, distance education has been started in our country and our teachers, who were not ready for this situation at the beginning, had trouble. At this point, web 2.0 tools will make significant contributions to preparing learning environments suitable for distance education, developing and applying materials. It is very important for pre-service teachers to have these qualifications before they graduate, both in enriching the teaching they will do in their teaching life and in being prepared for extraordinary situations. In this sense, it is thought that the data obtained from the study is

important in terms of being a source for in-service trainings to be given to teachers to use web 2.0 tools and academic studies to be made on this subject.

Suggestions

The suggestions made in line with the results obtained in this study, which was carried out to evaluate the effect of this education on pre-service science teachers' material design using Web 2.0 tools by applying a training for pre-service science teachers to use Web 2.0 tools in the teaching process, are presented below:

Elective courses can be given to pre-service science teachers in order to use Web 2.0 tools in undergraduate courses, or the content and course hours of the "Instructional Technologies" course can be increased.

During the applications, pre-service teachers mentioned the inadequacy of Turkish-supported Web 2.0 tools. By sharing the results of this study and similar studies in the relevant literature, it can be reached to authorized persons, and suggestions can be made about the dissemination of Turkish-supported material programs.

Pre-service teachers can be encouraged to develop materials by using Web 2.0 tools regarding the achievements given by the practice teacher during the school practice process and to use the developed materials in their lectures.

After the training developed for the teaching of Web 2.0 tools, it may be suggested to pre-service science teachers to plan a new research to examine whether they are used in school applications.

Ethical Statement

In this study, all the rules specified to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were complied with. None of the actions specified under the title of "Actions Contrary to Scientific Research and Publication Ethics", which is the second part of the directive, were not carried out. Ethics committee approval dated 10.26.2021 and numbered 2021/226 was obtained from Recep Tayyip Erdoğan University Social and Human Sciences Ethics Committee for this study. The study was produced from the master's thesis named "Examination of the Education Program Developed for the Development of Technology Supported Materials for Science Teacher Candidates: Web 2.0 Tools".

Conflicts of Interest

No potential conflict of interest was declared by the authors.

Credit Author Statement

This study was taken from the first author's master thesis conducted under the supervision of the second author. In this sense,

Author 1: Investigation, Conceptualization and Methodology, Writing- Original draft preparation.

Author 2 : Supervision, Investigation, Conceptualization and Methodology, Writing- Original draft preparation, Reviewing and Editing

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