The Effects of Science Teaching Practice Supported With Web 2.0 Tools on Prospective Elementary School Teachers' Self-Efficacy Beliefs

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Abstract

This study aims to analyse the effects of science teaching practices supported by Web 2.0 tools on prospective elementary school teachers' perceptions of self-efficacy beliefs in using Web 2.0 tools. The study was conducted in pre test-post test quasi-experimental design with no control group, and it was supported with qualitative data. The research was conducted with the participation of 40 prospective teachers registered in Elementary School Teaching Department of a state university in 2017-2018 academic year. The study was conducted throughout a semester (for 14 weeks) within the scope of the course Science and Technology Teaching II. The lessons were taught in consistence with constructivist learning approach directed to all the gains available in the 3rd and 4th grade Science teaching curriculum prepared by the Ministry of National Education (MNE) (2018) on the basis of student-centred methods and techniques by supporting with Web 2.0 tools. 23 Web 2.0 tools in total were used throughout the study. The "Web 2.0 Rapid Content Development Self-efficacy Scale" developed by Birişci, Kul, Aksu, Akaslan and Çelik (2018) in addition to an interview form of open-ended questions developed by the researcher to obtain prospective teachers' views on the use of Web 2.0 tools in science teaching were used in this study. Consequently, it was found that science teaching practices supported by Web 2.0 tools had positive effects on prospective elementary school teachers' their self-efficacy perceptions on the use of Web 2.0 tools. An examination of the participants' responses to the open-ended questions demonstrated that the participants said that Web 2.0 tools had positive impacts especially on the learning process and they were innovative and they improved upper order thinking skills, creativity and imagination and that they could be used especially in eliminating the anxiety and misconceptions in science teaching.

Key words: Web 2.0 Tools, Self- Efficacy, Science Teaching, Prospective Elementary School Teacher

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INTRODUCTION

Pedró (2006) describes today's children as "New Millennium Learners". One of the concepts used in the meaning of "New Millennium Learners" is Prensky's concept of "digital natives" (Prensky, 2001). Prensky (2001) labels those who are familiar with digital media instruments as "digital natives" and those who are not familiar with those instruments as "digital immigrants". A number of skills that today's students who are labelled as "digital natives" are referred to as the 21st century skills. Several different groupings are available in this respect. An examination of National Research Council (2012) in particular makes it clear that it is demanded that students in general develop such skills as problem solving, critical thinking, communication, collaboration and self-management skills- which are referred to as he "21st century skills" (Cited in Yalçın, 2018, p. 184). ISTE (b.t.) emphasised that students should meet certain standard so that they could actualise instances of effective learning in the digital world. The standards were distinguished as "creativity and innovation, communication and collaboration, research and flow of information, critical thinking, problem solving and decision making, digital citizenship and *use of technology*" (Cited in Günüç, Odabaşı and Kuzu, 2013, p. 438). Günüç, Odabaşı and Kuzu (2013) conducted a study on the 21st century skills through Twitter with the participation of prospective teachers. Following the interviews with the participants and the content analysis of their tweets, the characteristics of 21st students were divided into four main themes and ten sub-themes as personal skills (cognitive, intrinsic/self and social), research skills and skills of getting informed (researching, learning and getting informed), creativity, innovation and career skills (career and innovation) and technological skills (using and making widespread)- as in the literature. It is apparent from those findings that the expectations of societies have changed in the 21st century- in which we live- and the target of societies now is to raise individuals who can adjust to technological developments and changes, who can keep themselves up to date, who can generate knowledge and can use advanced technologies (Dağhan et al., 2017, p. 217), who have upper order thinking skills, who can work in teams and who have high communication capability.

Teachers began to follow and learn different and new applications so as to be able to attract the attention of new generation students- who are labelled as digital natives. Those rapid changes arising also influence educational and instructional environments. In consequence, technological devices such as smart boards, tablet PCs and 3D printers apart from traditional materials are also widely and effectively used in the classroom (Elmas and Geban, 2012). Teachers in Europe and in Turkey have been making projects by collaborating by means of projects such as E-twining and Scientix and by making use of technology. E-twining provides the necessary support, instruments and services through the use of information technologies , it facilitates schools to set up short-term or long-term partnership in any issue and thus it encourages cooperation between schools in Europe (http://etwinning.meb.gov.tr). Scientix project is a project which aims to make inquiry-based education in teaching science, technology, engineering and mathematics in Europe through Scientix portal and which is open to teachers, academicians, administrators, parents and anybody who is concerned with science and mathematics education (http://scientix.meb.gov.tr/).

One of the conditions for teachers- who play significant roles in the process of students learning- to rise individuals who are capable of using technology effectively and of developing it is that they should be able to use technology effectively and integrate it into instructional activities efficiently (Yanpar, Tokmak, Özgelen and İncikabı, 2013, p. 2). As Borich (2017) also states, it is difficult for teachers to keep students' attention alive if they address them only through oral presentations considering especially the fact that today's students are accustomed to visual stimuli and multimedia presentations. Teachers need classroom technologies leading to fundamental renovations and changes in teaching to attract students' attention and to meet various need of them (p. 208). The old patterns in the learning process have changed thanks to Web technologies. One of the reasons for it is that people now search for online learning environments rather than books and encyclopaedias in researching a subject. Another reason is the change in patterns of learning. Individuals wishing to reach knowledge can now access to the relevant experts through e-mail and social media. The third

reason is that individuals can be in the position of both learners and teachers since those devices offer ease in online learning (Shank, 2008, p. 244).

The major aim of Web 2.0 technologies- which were first suggested by Tim O'Reilly in an international conference in 2004- is to secure that people can share content without facing any technical obstacles and that they can make use of the social interaction and cooperation potential of the internet (Ata, 2011, p. 20). Web 2.0 tools in general represent a structure securing creativity, communication, safe information sharing, joint workability and functionality in web design (Uçak and Çakmak, 2010, p. 44). In other words, Web 2.0 technology means individuals' creating content easily and their contribution to the existing content on the internet (Atıcı and Yıldırım, 2010, p. 287). One of the most important sides of Web 2.0 tools is that they make it possible for teachers and learners to go out of the classroom environment and to contact people from all over the world about projects and ideas they want. Participants' web literacy and collaborative active participation come into play while they are using the Web 2.0 tools- which enable them to have practice with materials which are coded as open resource (Horzum, 2010, p. 612-613). Students can work at their own pace of learning by means of Web 2.0 technologies, which are student-centred. In this way, those technologies also enable learners to make self-improvement (Özerbaş and Mart, 2017, p. 1153).

Web 2.0 tools, which can easily be used by the young generation- who are digital natives- also started to attract teachers' attention. Teachers and prospective teachers who would like to appeal to a generation of "digital natives" have had the obligation to improve themselves in terms of technology. Teachers' and prospective teachers' perceptions of self-efficacy is also important here. As is commonly known, the concept of self-efficacy is a concept available in Bandura's theory of social learning. Bandura (1977) describes "individuals' beliefs in how well they can do the actions necessary for coping with any situation" as self-efficacy belief (Cited in Akkoyunlu and Orhan, 2003). That is to say, it is individuals' own judgement of their capacity to do an action (Lee, 2005, s. 490, Cited in Acar, 2019).

Various studies have been conducted today especially about teachers' and prospective teachers' self-efficacy perceptions. Prospective teachers' beliefs in themselves are capable of affecting their achievement in their professional life. The desire of prospective teachers who will be the teachers of a mass of people labelled as digital natives to use web 2.0 tools in particular in our time- when technology is so influential and when rapid advances occur- and the extent to which they consider themselves adequate in this respect is a subject that needs researching.

Prospective teachers themselves should learn about such these tools during their undergraduate education and their anxiety- if there is any- should be eliminated so that they can make teaching plans suiting to the characteristics of learners and so that they will not get out of date when they become practising teachers. A review of studies performed in this respect demonstrates that teachers' perceptions of self-efficacy in technology occupy a significant place in deciding on how much to benefit from technology in performing the teaching process (Abbit, 2011; Albion, 1999; Chen,2008; Cited in Birişçi, Kul, Aksu, Akaslan and Çelik, 2018, p.193).

A review of literature makes it apparent that generally such tools as Facebook, YouTube, Yahoo Messenger, Wikis, blogs and podcasts were considered in relation to the use of Web 2.0 tools (Ata, 2011; Baltacı Göktalay and Özdilek, 2010) or that the effects were researched by using only one or two Web 2.0 tools (Yılmaz, 2017; Zengin, Bars and Şimşek, 2017). The review of relevant literature also demonstrates that studies mostly focus on teachers' and prospective teachers' views and on how often they use such tools (Efe, Söylemez, Oral and Efe, 2014; Efe, 2015; Özerbaş and Mart, 2017; Özer and Özer, 2017).

Altıok, Yükseltürk and Üçgül (2017) taught many pre-service teachers attending various universities how to use the Web 2.0 tools within the scope of their project and then asked for their views. At the end of training, they stated their opinions about particularly the academicians who offered training within the scope of the project and about the gains they obtained after the activity. The

participants were offered applied education by means of several Web 2.0 tools in four days. While the prospective teachers said that they were pleased with the education they said that the duration of education was inadequate. The item that the participants considered the most negative was that the educational content was not associated with the students' domain of work. The reason for it was explained as the fact that the academic staff who were trainers were from computer and information technologies department. The following statement made by one of the participants in particular was remarking: *"It was too short. It would have been beneficial to make projects in groups. For example, it would have been more effective if they had added another week and if we had made group projects in our area of studies in week two*" (s. 4-5). In fact, the finding called attention to an important problem. In this respect, Mishra and Koehler (2006) mentions failure in teachers' integration of technology with teaching in general and they suggest the theory of Technological Pedagogical Content Knowledge (TPCK) to improve such competence.

Mishra and Koehler (2006) built "technology" on Shulman's formula of "pedagogical content knowledge" and thus they recommended a conceptual framework for educational technology. According to Mishra and Koehler (2006), TPCK is composed of three types of knowledge (technological knowledge, pedagogical knowledge and content knowledge) and of other knowledge which is the intersection of those types of knowledge (technological pedagogical knowledge, technological content knowledge, pedagogical content knowledge and technological pedagogical content knowledge). Mishra and Koehler (2009) describe TPCK as "the whole of knowledge about the representation of concepts through technology, the use of pedagogical techniques in positive ways to teach the knowledge in a domain, what makes concepts easy or difficult to learn and how technology helps to solve the problems learners encounter, students' prior knowledge and theories of knowledge and about how to use technology to develop new theories of knowledge on the basis of current knowledge or to strengthen the previous knowledge" (Cited in Timur and Taşar, 2011, p.p. 840-841). It was found on examining the studies available in the literature that teachers who were good at TPCK knew how to use technology in teaching, that they knew the length of time needed for teaching to be conducted with such technologies, that they knew how to solve the problems learners were probable to encounter with technology, and how to regulate teaching and learning according to technological possibilities (Canbazoğlu Bilici, Yaman and Kavak, 2012).

This study is important in that it is an experimental study enabling prospective elementary school teachers to learn by doing and by experiencing how to use the Web 2.0 tools and what pedagogical techniques to use to teach the subjects available in science teaching curriculum prepared by MNE (2018).

This paper seeks answers to the question of whether or not science teaching conducted with the support of Web 2.0 tools had any significant differences on prospective elementary school teachers' self-efficacy beliefs in Web 2.0 tools. The research questions were formulated as in the following:

1. Do practices of science teaching supported with Web 2.0 tools have any significant differences on prospective elementary school teachers' self-efficacy beliefs in Web 2.0 tools?

    a) Do practices of science teaching supported with Web 2.0 tools have any significant differences on the sub-factors of "preparation", "presentation" and "evaluation"?

    b) Do prospective elementary school teachers' self-efficacy beliefs in Web 2.0 tools differ significantly according to gender?

2. What are the views held by prospective elementary school teachers in relation to teaching conducted with the support of Web 2.0 tools?

METHOD

Research Model

This study was performed by using single group pre-test- post-test experimental design, one of the quantitative research approaches investigating the effects of science teaching conducted with the support of Web 2.0 tools on prospective elementary school teachers' self-efficacy beliefs in Web 2.0 tools. A group is given a pre-test measurement first and then it is given an experimental procedure in such a design and finally the group is given a post-test (Cresswell, 2014, p. 172). Several and differing types of qualitative data in addition to "Web 2.0 Rapid Content Development Self-efficacy Scale" were used so as to be able to interpret the process. Observation form were completed every week throughout the semester, all the digital materials were evaluated, the differing and remarkable parts of the prospective teachers' presentations were video recorded, the responses to the open-ended questions were put to content analysis and the participants' statements were quoted directly. The researcher had the opportunity to make long observations and to collect long term data since she was also the lecturer who taught the course. In this context, the criteria related to validity and reliability in particular (long-term interaction, diversification, participant approval, detailed descriptions) recommended by Yıldırım and Şimşek (2006, p. 265) were taken into consideration in the qualitative part of the study. Using the data collected in different methods to confirm each other increases the validity and reliability of the conclusions reached (Yıldırım and Şimşek, 2006, p. 267).

The Study Group

The study was conducted with the participation of 40 prospective teachers (27 female and 13 male) who were the third-year students in the elementary school teaching department of a state university. It was found in an interview with the participants at the beginning of the semester that they had never heard of Web 2.0 tools before and neither had they used them before. The prospective teachers were informed of the course content at the beginning of the semester. They said that they would like to take part in the research voluntarily.

Data Collection Tools

Web 2.0 Rapid Content Development Self-efficacy Belief Scale: The "Web 2.0 Rapid Content Development Self-efficacy Belief Scale" developed by Birişçi, Kul, Aksu, Akaslan and Çelik (2018) was used as the tool of data collection in this study. The maximum score receivable from the 5-pointed Likert type 21-item scale was 105 whereas the minimum score receivable from the scale was 21. The scale contained three sub-factors labelled as preparation, presentation and evaluation. Differing scales are available in the literature. However, this scale- which was developed by Birişçi, Kul, Aksu, Akaslan and Çelik- includes items with statements to determine the adequacy level of using the Web 2.0 tools at the stages of planning a lesson as different from all other scales. In that case, the purpose is to determine the lesson planners' adequacy levels of including the Web 2.0 tools in the educational-instructional process.

The Interview Form: A form of six open-ended questions was used. Question one asked what Web 2.0 tools the prospective teachers used, question two asked the participants to tell three Web 2.0 tools they liked using the most and why they liked them, question three asked them the positive sides of using Web 2.0 tools in classes and the reasons for them, question four asked the restrictions and reasons for the restrictions, question five asked them whether or not they would like to use Web 2.0 tools when they become teachers and the reasons for their choice and finally question six asked them to make recommendations for using Web 2.0 tools effectively in science teaching.

The Observation Form: An observation form prepared by the researcher was used in evaluating the Web 2.0 tools the prospective teachers used and the lesson presentations they made throughout the semester. The weeks, the web 2.0 tools used by the groups and for what subjects they

used the tools were regularly written down. The observation forms were evaluated for the groups who made presentations according to a rubric which was prepared by considering the analysis and unity of the units of science course. The groups who made presentations about the units of science course were evaluated by both the researcher and the other students through observation forms each week. At the end of lessons, each prospective teacher was given feedback about the points which were found positive or negative during the observations.

Digital materials prepared by using the Web 2.0 tools: All the digital materials prepared by the prospective teachers were collected at the end of the semester and were evaluated in terms of principles of material preparation, and the way they considered science subjects was examined in detail. The parts lacking as well as the best examples were noted down for each group.

Research Process

The study was conducted with the participation of 40 prospective teachers attending the elementary school teaching department of a state university in 2017-2018 academic year. The applications lasted throughout the semester (for 14 weeks) within the scope of the course Science and Technology Teaching II. Prior to the application, the "Web 2.0 Rapid Content Development Self-Efficacy Belief Scale" was given as the pre-test. The prospective teachers were informed of Web 2.0 tools by making them a 2-hour presentation about Web 2.0 tools at the beginning of the semester. Two elementary school teachers were invited into the classroom within the scope of the course and they shared concrete examples by describing the Web 2.0 tools they used in their classes and by demonstrating them in the classroom. In this way, two practising teachers (1 male and 1 female) teaching in two different state schools informed the prospective teachers of the tools and thus it was understood that the issue was not only in theory but that it was also in practice. Of the teachers invited into the classroom, the female one had 12-year teaching experience while the male one had 20-year teaching experience. The researcher intended to arouse the prospective teachers' curiosity about the semester with such remarkable activities at the start of the semester. The visiting teachers made a brief evaluation by using the application "Kahoot", found the participant with the biggest number of correct answers, gave a pen to the winning participant and thus promoted participation. All the prospective teachers listened carefully from the beginning to the end, and they were informed of the applications. They had the opportunity to ask the teachers questions at the end of the lesson. Meanwhile, the researcher joined the class as an observer and thus had the opportunity to observe the prospective teachers' excitement. All the activities available in the course Science and Technology Teaching II were done by using the Web 2.0 tools in the following weeks under the guidance of the researcher. All the class downloaded the application "Edmodo" with the guidance of the lecturer and they kept online interaction throughout the semester. They had the opportunity to reach the lecturer when they had problems.

The students were divided into 9 groups to prepare the activities in relation to the gains available in the science teaching curriculum prepared by the Ministry of National Education (MNE, 2018). Each group shared the units available in the in the 3rd and 4th grade curricula for science teaching, and they were allowed time to prepare activities for the units they were assigned. Science activities were designed by using different Web 2.0 tools for the relevant gains each week. The groups planned the teaching process by blending together the student-centred methods and techniques which were consistent with constructivist teaching and discovery learning in preparing the subjects they were given. Activities to improve problem-based learning, project-based learning, experimental method and scientific process skills were planned within the scope of the course and were conducted with the guidance of the researcher. The groups told the researcher about their projects a week before their presentation and asked for the researcher's views about the projects throughout the semester. They investigated the Web 2.0 tools that they would use under the heading of "technological knowledge"- a component of TPCK- and they learnt how to use them. They determined how to integrate the Web 2.0 tools that they would use in the section of "technological content knowledge" and they chose the appropriate tools according to subjects and thus they evaluated the tools. After the first three weeks,

the prospective teachers had the freedom to choose the Web 2.0 tools so that their "technological content knowledge could develop, and thus they shared with the researcher the Web 2.0 tools they researched and wanted to use prior to their presentation and they exchanged views with the researcher.

Each group prepared concept maps with "inspiration" or "mindmeister" programme for the whole unit they were responsible for. The researcher observed throughout the semester that the groups mostly used such tools as "Kahoot", "Inspiration", "Quiver" and "Plickers" in their presentations. The Web 2.0 tools that the prospective teachers liked using are mentioned in the findings section. Each group was also told to introduce a web 2.0 tool that had not been used in the classroom before. The web 2.0 tools used in the classroom in the previous weeks could also be used again. All the participants learnt a new application each week before leaving the class. 23 Web 2.0 tools in total were used during the semester. The "Web 2.0 Rapid Content Development Self-Efficacy Belief Scale" was given as the post-test at the end of the semester. In addition to that, the interview form containing open-ended questions was also distributed to the prospective teachers. All prospective teachers completed the forms eagerly at the end of the process and supported the research. During the application, the prospective teachers were informed of Web 2.0 tools according to the grouping shown in Table 1. The information about the units available in the MNE (2018) curriculum for science teaching and the Web 2.0 tools used are shown in Table 2.

Table 1. A Classification of Web 2.0 Tools Used in the Application according to the Areas of Use

Types	**Web 2.0 Tools**
Evaluation	Kahoot, Socrative, Plickers, Learningaps, Easytestmaker, Mentimeter, Quizlet, Socrative
Video-Animation-presentation	Voki, Poplet, Powtoon, Goanimate, Phet, Prezi, Genially
Augmented reality	Aurasma (HP Reveal), Chromville, Quiver
Concept map	Inspiration, Mindmeister, Goconqr
Cartoon	Toondoo
Poster-bulletin board	Canva, Padlet
Coding	Code.org, QR Reader, Scratch
Digital story	Photostory

Table 2. The Science Units Taught and the Web 2.0 Tools Used During the Study

Groups	Distribution of Science Course Units	Web 2.0 Tools Used
Group 1	3.1 and 4.1	Inspiration, Kahoot, QR Reader
Group 2	3.2 and 4.2	Inspiration, Aurasma, Canva
Group 3	3.3 and 4.3	Inspiration, Plickers, Quizzlet, Scratch, Learninggaps, Powtoon, Prezi, Aurasma, Voki, Poplet
Group 4	3.4 and 4.7	Toondoo, Voki, Kahoot, Quizlet, Socrative, Phet, Padlet, Powtoon, Genially, Learninggaps
Group 5	4.4	Powtoon, Goconqr, Padlet, Toondo, Aurasma
Group 6	3.5	Inspiration, Kahoot, Powtoon, Quizlet, Photostory, Easy test maker, Mentimeter, Socrative, QR Reader
Group 7	4.5	Inspiration, Voki, Plickers, Padlet, Powtoon, Prezi, Kahoot, Aurasma
Group 8	3.6 and 4.6	Inspiration, Plickers, Kahoot, Powtoon, Mindmeister
Group 9	3.7	Inspiration, Learningapps, Powtoon, Voki, Toondo, Aurasma, Quizlet.

Data Analysis

Quantitative Findings and Interpretations

The normal distribution of the data which are the parametric test assumptions of the data obtained from the scale aiming to determine the prospective teachers' Web 2.0 rapid content self-

efficacy beliefs and the homogeneity of variances were tested statistically. Whether or not the data coming from the groups had normal distribution was analysed with "skewness and kurtosis coefficients" and with "Kolmogorov-Smirnov test" and the homogeneity of variance was analysed with Levene's Test of Equality of Error Variances. It can be said that the distribution of the data is normal and that the variances are not homogenous because the p values were found to be smaller than 0.05 at the end of the Smirnov test and Levene's test and because the skewness-kurtosis coefficients were not within the desired interval (-1, +1). Non-parametric statistics were used since the data did not meet the parametric test conditions after the analyses.

Wilcoxon signed rank test was used to check whether or not science teaching practice supported with Web 2.0 tools had any significant differences in the scale aiming to determine prospective elementary school teachers' Web 2.0 rapid content development self-efficacy beliefs and in its sub-factors (preparation, presentation and evaluation). On the other hand, Man Whitney U test was used to check whether or not prospective teachers' self-efficacy beliefs in Web 2.0 tools differed according to gender. The effect size (r) was calculated in determining the power of correlations between variables, and consequently, the values of 0.10, .30 and 0.50 were interpreted as small, medium and large effect size, respectively (Cohen, 1998). The data were analysed on SPSS 23.0 package programme. Bonferroni correction was made in the analysis of the data to check the type 1 errors. Bonferroni correction is determined with the formula significance level/the number of groups (Vialatte and Cichocki, 2008). Significance level was found as 0.05/2=0.025 when the number of groups is 2 in this study.

Findings and Interpretations

Whether or not science teaching practice supported with Web 2.0 tools caused any significant differences in the scale for determining prospective teachers' beliefs in Web 2.0 rapid content development self-efficacy and in the sub-factors of the scale (preparation, presentation and evaluation) was checked through Wilcoxon signed rank test, and the results are shown in Table 3.

Table 3. Wilcoxon Signed Rank Test results for the Pre-test and Post-test scores received from the Scale and from the sub-factors of the scale aiming to determine the beliefs of prospective elementary school teachers who practise science teaching supported with Web 2.0 tools in Web 2.0 rapid content development self-efficacy

Beliefs in Web 2.0 tools self-efficacy scale	Post test-pre test	n	Rank mean	Rank total	z	p	r (effect size)
Preparation	Negative rank	2	1.50	3.00	5.47*	0.00**	0.86
	Positive rank	38	21.50	817.00			
	Equal	0					
Presentation	Negative rank	5	3.10	21.98	15.50	5.16*	0.00**	0.82
	Positive rank	33			725.50		
	Equal						
Evaluation	Negative rank	2	1.50				
	Positive rank	2	21.00	3.00	5.41*	0.00**	0.85
	Equal	37		777.00			
Total	Negative rank	1	1.50				
	Positive rank	2	21.50	3.00	5.47*	0.00**	0.86
	Equal	38		817.00			
		0					

*based on negative rank
**p<0.01

The results for Wilcoxon Signed Rank Test done to find whether or not the pre-test and post-test scores of the participants who practised science teaching supported with Web 2.0 tools and the scores they received from the whole scale differed significantly are shown in Table 1. The analysis results demonstrated that there were significant differences between the pre-test and post-test scores

received from the preparation (z=5.57; p<0.01), presentation (z=5.16; p<0.01) and evaluation (z=5.41; p<0.01) sub-factors of the scale for beliefs in web 2.0 tools self-efficacy and from the whole scale (z=5.47; p<0.01). Considering the rank mean and rank total of the differences in scores, it is apparent that the difference is in favour of positive rank, that is to say, in favour of post-test scores. Accordingly, it may be said that science teaching practice supported with web 2.0 tools have significant effects on increasing the prospective elementary school teachers' beliefs in web 2.0 tools self-efficacy. On examining the effect sizes for the Wilcoxon signed rank test in the sub-factors and in the whole scale, the effect size (r) was found as 0.86, 0.82, 0.85 and 0.86 for the sub-factors of the scale and for the whole scale. Thus, the effect was high for the sub-factors and for the whole scale, and therefore it can be said that the difference between the pre-test and post-test scores that the prospective teachers doing science teaching practice supported with web 2.0 tools received from the scale is big.

Whether or not the beliefs of prospective elementary school teachers practising science teaching supported with web 2.0 tools in web 2.0 tools self-efficacy differed according to gender was tested with Mann-Whitney U test, and the results are shown in Table 4.

Table 4. The Mann-Whitney U Test Results for The Beliefs of Prospective Elementary School Teachers Practising Science Teaching Supported with Web 2.0 Tools According To Gender

Beliefs in Web 2.0 tools self-efficacy scale	Gender	n	Rank mean	Rank total	U	p
Preparation	Female	27	17.98	485.50	107.50	0.05
	Male	13	25.73	334.50		
Presentation	Female	27	19.20	518.50	140.50	0.30
	Male	13	23.19	301.50		
Evaluation	Female	27	18.59	502.00	124.00	0.13
	Male	13	24.46	318.00		
Total	Female	27	18.50	499.50	121.50	0.12
	Male	13	24.65	320.50		

An examination of Table 4 makes it clear that there are not significant differences between scores received from the preparation (U=107.50; p>0.025), presentation (U=140.50; p>0.025) and evaluation (U=124.00; p>0.025) sub-factors of the scale for beliefs in web 2.0 tools self-efficacy and from the whole scale (U=121.50; 0.025) according to gender. This indicated that gender did not have significant effects on prospective elementary school teachers' beliefs in web 2.0 self-efficacy- that is to say, there were no significant differences between male and female prospective elementary school teachers' web 2.0 tools self-efficacy beliefs.

Qualitative Findings and Interpretations

The participants' responses to the open-ended questions were put to content analysis. Efforts were made to describe the data and to reveal the truths that may be hidden in the data through content analysis. The participants' responses were examined one by one and the meaningful words and sentences available within the data were labelled and coded. Then, the codes were divided into themes (Yıldırım and Şimşek, 2006, pp. 227-238). The frequencies were calculated by basing the responses on fundamental points. Direct quotations were also made to present the remarkable data. Another expert was also consulted in coding and in distinguishing the themes. The agreement between the experts was calculated by using the formula suggested by Miles and Hubberman (1994), and the agreement was found to be 89%. Having a value above 70% indicates that there is agreement between coders (Miles & Hubberman, 1994). The participants were informed of the study, and they were told that their names would be kept confidential. For the confidentiality of the names, codes such as K1, K2, etc. were used in this study.

Table 5. The Participants' Views on the Web 2.0 Tools they most Frequently Chose to Use

Categories	Codes	f
Evaluation	Kahoot	19
	Plickers	5
	Quizlet	5
	Socrative	1
	Learningaps	1
	Mentimeter	1
	Flipquiz	1
Augmented reality	Aurasma (HP Reveal),	13
	Chromville,	2
	Quiver	2
Concept maps	Inspiration,	11
	Mindmeister,	1
Videos-animations-presentations	Powtoon	6
	Voki	3
Posters-bulletin boards	Canva	4
	Padlet	2
Cartoons	Toondoo	2
Coding	Scratch	1
Digital stories	Photostory	1
Other	Google	1

According to Table 5, the web 2.0 tools that the participants most frequently choose to use are divided into 9 categories. The categories are distinguished as evaluation, augmented reality, concept maps videos-animations-presentations, posters-bulletin boards, cartoons, coding, digital stories ant other. Responses related to each category were also coded. Consequently, it was found that the participants preferred to use the web 2.0 tools in the categories of "evaluation, augmented reality and concept maps" the most frequently. The frequencies for the codes in each category are shown in the Table. Thus, it was found that "Kahoot" in the category of evaluation, "Aurasma-HP Reveal" in the category of augmented reality and "Inspiration" in the category of concept maps were the most frequently chosen web 2.0 tools. Some of the views justifying the choices were as in the following:

K1: "I liked Kahoot the most because I had fun even when racing. I think students will like it more than I do."

K3: "It was photo story because it is both entertaining and didactive. It appeals to more than one sense."

K5: "It was Kahoot because it helps to make students love the test."

K7: "It was Aurasma because it was amazing just like a symbol's coming to life."

K10: "It was Kahoot because I had never thought that evaluation was so easy."

K13: "It was Aurasma because it was the irreplaceable in the digital bulletin board."

K14: "It was Inspiration because it is more useful to form our own concept maps while teaching a subject."

K15: "It was Aurasma because we sometimes have limited possibilities. We may not show or see some of the things alive." It is an advantage."

K22: "It was Padlet because it was easy to use."

K25: It was Powtoon because it supported teaching the subject and we could use our own voice."

K27: "It was Voki because we could animate. It offered a more enjoyable learning environment."

K36: "It was Plickers because students may not have technological resources (computers, Tablet PCs, etc.). This tool can be used with anybody."

K37: "It was Inspiration because I myself also make concept maps or mind maps while studying. Just like summarising. It makes sure that all the knowledge is here, in my hands."

Table 6. The Participants' Views on the Positive Sides of Using Web 2.0 Tools

Categories	Codes	f
Effects on the learning process	Attracting attention to the lesson	12
	Meaningful learning	7
	Learning easily	4
	Learning by having fun	4
	Retention in learning	3
	Learning by doing and experiencing	3
	Visual learning	2
	Easy applicability	2
	Teaching self-efficacy perception	2
	Versatile learning	1
	Learning differently	1
	Student-centred	1
Effects on students	Appealing to the "z" generation	4
	Improving imagination	1
	Developing self-confidence	1
	Promoting achievement	1
	Assuring competition between students	1
	Contemporary	1
	Innovativeness	1
	Providing scientific knowledge	1
	Possibility to reach multiple data	1
Effects on upper order thinking skills	Problem solving skills	1
	Critical thinking skills	1
Other	Positive effects on the process of teaching	6

As clear form Table 6, the participants views on the positive sides of Web 2.0 tools were considered in 4 categories labelled as "effects on the learning process", "effects on students", "effects on upper order thinking skills" and "as "other". Several meaningful codes were obtained especially in the categories of "effects on learning process" and "effects on students". the codes of attracting attention to the lesson, meaningful learning, learning by having fun, retention in learning and learning by doing and experiencing were the codes with the highest frequency in the category of effects on the learning process. Codes such as appealing to the z generation, improving imagination, developing self-confidence and innovativeness were obtained in the category of effects on students. It was a remarkable finding that the participants mentioned positive effects on problem solving skills and on critical thinking skills in the category of effects on upper order thinking skills. 6 participants said that using the web 2.0 tools had generally positive effects on the process of teaching in the category of "other". Some of the participants' views on the positive effects of using the web 2.0 tools were as in the following:

K1: "we will certainly be valued in the schools we teach and we will be advantages compared to other teachers. I am sure I will motivate students to participate in classes and to be curious."

K7: "They enable a different type of and versatile teaching. Many tools are enjoyable and easy to understand. The tools will certainly attract students' attention when they see them."

K14: "Now there is technology in every part of life". We are technology immigrants, but our students are technology natives. They are born into technology. Teaching them with those programmes will be more fun and more understandable to them."

K 23: "Students' attention can be attracted to lessons more quickly. Teachers can reach a lot of data instantly."

K25: I find web 2.0 tools useful because they transfer knowledge through an activity instead of transferring it directly and because they help us do it through technology. Another positive side is that they put students into a competition with each other."

Table 7. The Participants' Views on the Limitations of Using the Web 2.0 Tools

Categories	Codes	f
Physical and materialistic conditions	Inadequate school infrastructure	17
	Need for tablet PCs and personal computers	10
	Difficulty in application in crowded classrooms	7
	Economic problems	1
From the aspect of students	Not attracting attention due to technological satisfaction	3
	Appropriacy to students' level	1
	Unsociability	1
	Getting away from nature	1
From the aspect of teachers	Inability to use technology	2
	Time limitation	2
Stemming from Web 2.0 tools	Need for updating	1
	Language of use being English	1

An examination of the participants' views about the limitations of using the web 2.0 tools shown in Table demonstrates that there are four categories labelled as "physical and materialistic conditions", from the aspect of students", "from the aspect of teachers" and "stemming from web 2.0 tools". The headings coded as inadequate school infrastructure, need for tablet PCs and personal computers and difficulty in application in crowded classrooms stand as the codes for which the most frequently views are stated in the category of "physical and materialistic conditions". On the other hand, it was stated in the category of "from the aspect of students" that they might not attract students' attention due to technological satisfaction, that they might not be appropriate to students' levels and that students might be isolated from nature or become anti-social if there are too many applications. Two participants stated in the category of "from the aspect of teachers" that there could be limitations due to inability to use technology. In the category of "stemming from web 2.0 tools", however, it was stated that there could be problems stemming from time limitations, that some of the applications needed updating and that English as the language of use could cause problems. Some of the participants' views on the limitations of the web 2.0 tools were as in the following:

K3: "The limitations of the web 2.0 tools, the economic status of the students in the classroom and the technological inadequacy of the class. Another limitation can be the teachers' lack of education in this matter."

K7: "The technological lack of the school, the teachers' status in using and preparing, the teacher's ability to use technological tools are the limitations."

K15: "They are difficult to use in classrooms."

K22: "every student may not have their own Tablet PC or computer. So we cannot always use them."

K24: "It is not so easy to have access to technology in every school or in every region. For this reason, we can use them in a limited number of locations".

Table 8. The Participants' Views on the Use of Web 2.0 Tools in Science Teaching

Categories	Codes	f
Benefits in the process of teaching	Science teaching course as the most appropriate course	4
	Learning by having fun	3
	Being able to use at any stage of the lesson	2
	Improving creativity	2
	Reinforcing the subjects	1
	Promoting the quality of teaching	1
	Eliminating the science anxiety	1
Benefits in science subjects	Concept teaching	
	In simplifying the difficult concepts	3
	In eliminating misconceptions	2
	In teaching abstract concepts	2
	Suitability to any subject	5
	Suitability to experimentation-observation	2
	In reinforcing the subjects	2
Recommendations	Courses should be added in undergraduate[1]	5
	In-service training should be offered	4
	More web 2.0 tools should be used in relation to the gains.	2

According to Table 8, the participants' views on the use of Web 2.0 tools in science teaching is considered in three categories distinguished as "benefits in the process of teaching", "benefits in science subjects" and "recommendations". On examining the codes included in the category of "benefits in the process of teaching", the codes that science course was the most appropriate course for using web 2.0 tools, that they could be used at any stage of lessons, that they could improve creativity and that the science anxiety could thus be eliminated were remarkable. Views related to effects on concept teaching especially were stated in the category of "benefits in science subjects". One of the issues teachers have difficulty in teaching is naturally the process of concept teaching in science education. There are several studies on identifying and eliminating misconceptions in particular in the literature. Prospective teachers say that web 2.0 tools will be beneficial due to the fact that teaching abstract concepts is a more challenging job. Their recommendations in this respect are capable of contributing to the area. They suggest that there should be courses in undergraduate education and practising teachers should also be taught the tools through in-service training and seminars.

Some of the views held by the participants in relation to the use of web 2.0 tools in science teaching were as in the following:

K9: "They can be taught to all students in universities in a programme. I think it will be more efficient and students will use them more efficiently in this way."

K13: "In my opinion, tools should be known very well. In this way, one can be more effective and more efficient."

K24: "Prospective teachers can be offered comprehensive courses about what web 2.0 tools are and about how to use them. More could be invested in the field of education and environments that teachers can use in their classrooms can be formed."

K27: "They provide more effective learning environments than classical methods in especially difficult subjects like electricity in which it is possible to have misconceptions and there are abstract concepts. We can use them in every subject we study this semester and at any stage of lessons readily. Prospective teachers should be offered a course in the use of web 2.0 tools just like a course in using computers. We didn't know any applications apart from Kahoot before the course Science Teaching."

[1] After this study, the researcher made the recommendation in the faculty she worked that an elective course on using web 2.0 tools be included in the undergraduate programme. Consequently, such a course was offered to prospective elementary school teachers officially as an elective course in the Fall semester of 2019-2020 academic year.

K30: "They should absolutely be used in science teaching.. I think every teacher should use them."

K32: "Experimentation, observations and more than that can be done in the classroom. Kids can see and make comments on what they see. It would be great."

DISCUSSION AND RECOMMENDATIONS

We live in an era in which technological developments are rapid and we are surrounded by several technological tools and equipment. It seems impossible in such an environment to force the young generation- whom we describe as digital natives- to attend classes in traditional classrooms and to educate them away from technology in traditional methods (Eryaman, 2007; Elmas and Geban, 2012, p. 251). The educational-instructional environments and programmes should be regulated by taking the characteristics of today's students into consideration in the light of the above-mentioned fact. In this context, this current paper aimed to make prospective teachers familiar with the web 2.0 tools- which have been increasingly used today- and to make them see that they can use the tools in the science teaching course. They were given the opportunity to have one-to-one practice with web 2.0 tools that they could make use of. This paper intended to show prospective teachers that web 2.0 tools are not only technological tools but that they should also learn how to use them by doing and by experiencing according to the course book units and gains mentioned in the curriculum prepared by MNE (2018). A teaching process suitable to all the components of TPCK (content knowledge, pedagogical knowledge, pedagogical content knowledge, technological knowledge, technological content knowledge, technological pedagogical knowledge, technological pedagogical content knowledge) was planned. In this way, the prospective elementary school teachers learnt what the web 2.0 tools involved and what web 2.0 tools to use and how to use them in the process of making students active while teaching the science subjects they were assigned. Efforts were made to cause positive effects on their beliefs in self-efficacy in web 2.0 tools through study made during the semester. Thus, they were offered guidance to use those tools easily without having a feeling of apprehension and with full self-confidence when they become teachers.

The findings obtained in this study demonstrated that the sub-factors of the scale (preparation, presentation, evaluation) and the whole scale had large effects and that there were big differences between the pre-test and post-test scores in the beliefs of the prospective teachers who practised science teaching supported with web 2.0 tools in self-efficacy in Web 2.0 tools. Accordingly, it may be said that applications of science teaching supported with web 2.0 tools had significant effects on increasing their beliefs in self-efficacy in web 2.0 tools. The sub-factors of the scale also represent the stages of a lesson. Therefore, it was found that the scale caused considerably significant differences in the prospective teachers teaching in preparation, presentation and evaluation. As evident in the qualitative findings, the participants also stated that those tools could be used at any stage of a lesson.

Another finding demonstrated that there were no significant differences between male and female prospective teachers' beliefs in web 2.0 tools self-efficacy. That is to say, it was found that gender did not have significant effects on the participants' beliefs in their self-efficacy in web 2.0 tools. Researchers who worked with prospective teachers in TPCK applications and analysed self-confidence (Bağdiken and Akgündüz, 2018; Meriç, 2014) did not find any differences between levels of self-confidence according to gender. The interpretation that all the prospective teachers regardless of gender use technology and that they internalise it can be made as Bağdiken and Akgündüz (2018) also state.

Elmas and Geban (2012, pp. 250-251) classified the benefits of web 2.0 tools as the benefits of using web 2.0 tools", "the benefits of using web 2.0 tools for students", and "the benefits of using web 2.0 tools for the classroom environment in addition to the classification recommended by Byrne (2009) as "efficiency", motivation", learning" and "learning to learn". The categories and codes distinguished in this current study in relation to the positive sides of web 2.0 tools in the analyses are also similar to the ones available in the above-mentioned studies.

On examining the qualitative findings obtained through the interview questions in this study, the codes such as "appealing to the z generation", being innovative", "being contemporary" and "effects on upper order thinking skills" in the prospective teachers views on the positive sides of web 2.0 tools can be interpreted as being associated with the competencies described in the science teaching curriculum prepared by MNE in 2018. The national competencies were described and presented under 8 headings in the curriculum. Those competencies- which are supportive of one another and which are mostly inclusive of another- are listed as communication in native language, communication in a foreign language, competence in mathematics and basic competence in science/technology, digital competence, learning to learn, social and citizenship competence, taking the initiative, and cultural awareness and statement. It is pointed out in the curriculum that those competencies should be considered important to be able to raise individuals who achieve success in information society (MNE, 2018, pp. 5-6). The views that the participants stated about the positive sides of web 2.0 tools are important in that they are parallel to the competencies targeted in the curriculum.

The results obtained in this study are similar to the ones obtained in the literature. Akkaya (2019) concluded that the activities developed in relation to computer hardware with the help of web 2.0 tools had positive effects had positive effects on learners' achievement, on their attitudes towards computers and on their perceptions of self-efficacy in developing web 2.0 activities. The participants said in the interviews that they found web 2.0 tools easy, convenient and enjoyable to use and that they also wanted to use those tools in other courses. The findings obtained in terms of perceptions of self-efficacy in developing web 2.0 activities and the findings obtained from the participants' views were similar to the ones obtained in this study.

Whereas the prospective teachers referred to the property of "attracting attention to the lesson" as positive side of web 2.0 tools in Table 6, three participants laid emphasis on "not attracting attention due to technological satisfaction" in Table 7. Based on this finding, researchers and teachers can get the message that they should use web 2.0 tools in their classes in place and in sufficiently by considering their limitations as well as the positive sides.

The qualitative results obtained in this study are similar to the ones obtained in Bolatlı and Korucu (2018). Bolatlı and Korucu (2018, p. 476) found that using web 2.0 tools made STEM educational environments enjoyable. One of the prospective teachers included in the study said that the science should always be taught like that. The participant emphasised that retention in teaching would be attained and that learning would be easier in this way (p. 473). It was another finding reported that students would actively participate in classes and they would not feel bored in teaching in the form of group work and that positive effects would be caused on students with low self-confidence and achievement.

The participants in this study stated the views that using web 2.0 tools in classes could have positive effects especially on the learning process and that it would increase learners interest and achievement in the course. Baltacı Göktalay and Özdilek (2010) found that prospective teachers had positive attitudes towards web 2.0 tools and that they said they wanted to use such technology in their professional life. Batıbay (2019) investigated the effects of Kahoot- a web 2.0 tool- on motivation and achievement in Turkish classes in a study conducted with the participation of secondary school students. Accordingly, the researcher observed increase especially in the students' motivation. Özdemir and Esen (2018) recommended different types of tools in relation to how to use web 2.0 tools in measurement and evaluation in particular. The researchers pointed out with examples that students' engagement would increase in lessons that were taught by using web 2.0 tools and that classes would be more enjoyable.

The results obtained in this study are similar to the ones obtained in another study. Ünlüer (2018, p. 59), in a study conducted with the participation of prospective teachers, reported that the use of web 2.0 tools in lessons taught by prospective teachers made lessons more enjoyable, that it secured learning by having fun, that it attracted students' attention, that they participated in lessons more

actively, that it resulted in retention in learning and that it made the learning process easier by making classes no longer monotonous. The participants also stated views on the limitations of web 2.0 tools in the study. Accordingly, they said that web 2.0 tools could not be used in learning environments unless the internet and the required hardware is not available, that the use of such tools necessitated prior knowledge on the part of teachers and students and that using those tools would cause harm rather than benefits if they are not use with appropriate integration strategies (p. 59). Those limitations described at the end of the study conducted by Ünlüer (2018) are parallel to the codes distinguished in this study on the basis of the prospective teachers' statements about " the inadequacy of school infrastructure", " the need for Tablet PCs and personal computers" and "being difficult to use in crowded classrooms". While the prospective teachers said that web 2.0 tools would have positive effects on the process of teaching on the one hand, they also stated their apprehensions that might stem from inadequacy of technical equipment and technological infrastructure on the other hand. More should be done to resolve the problems related to crowded classrooms and to the lack of technological equipment and materials in classrooms. As is commonly known, teachers' and prospective teachers' beliefs in their self-efficacy in the teaching process is one of the important factors influential in their achievement in classroom management and in increasing students' motivation and achievement (Özdemir, 2008, p. 279). In the context of today's technologies, identifying teachers' and prospective teachers' beliefs in their self-efficacy in web 2.0 tools and their professional development depending on this play important parts in organising in-class activities with those technologies (Birişçi, Kul, Aksu, Akaslan and Çelik, 2018, p. 193).

Ministry of National Education (2008) identified 6 main competencies, 31 sub-competencies and 233 performance indicators within the scope of "General competencies of Teaching Profession". technology-related performance indicators are available in the two sub-competencies "securing personal development" and monitoring and contributing to professional developments" under the heading of "personal development competencies". The performance indicators mentioned are "having technology literacy", "following the developments in information and communication technologies" and "benefiting from information and communication technologies to support their professional development", respectively. In the sub-competency of "considering the interest and needs" under the main competency of "recognising students", the performance indicator of "preparing learning environments suitable to students with different experiences, characteristics and abilities by using information and communication technologies" is available. The performance indicator "including in the lesson plan how to use information and communication technologies" is available under the sub-competency of "lesson planning" under the main competency of "teaching and learning process". Performance indicator of "accessing to resources related to teaching-learning and evaluating them in terms of accuracy and appropriacy" available under the sub-competency of "material preparation" under the same main competency is also remarkable. Another performance indicator, "setting models to using technological resources effectively and teaching them" is available under the sub-competency of "arranging learning environments". The performance indicator of "taking precautions prioritising health and safety in learning environments where equipment and materials and technology are used" is available under the sub-competency of "behavioural management". The performance indicators of "analysing the data by using information and communication technologies" and "sharing the results of evaluation with parents by using information and communication technologies" under the sub-competency of interpreting the data by analysing them, and giving feedback about the development of students" under the main competency of "monitoring and evaluating learning and development" are also available (MNE, 2006, pp. 8-43).

Taking those performance indicators into consideration, it is apparent that integrating technology into education is apparent in the process of teacher training. Therefore, universities- which are the teacher training institutions- should take those needs into consideration and plan the educational-instructional process accordingly. Considering those findings and the similar findings obtained in the literature, the following could be recommended to the future researchers:

Academic staff can offer prospective teachers of all branches applied teaching of how to plan teaching with web 2.0 tools during undergraduate education. Thus, detailed information on different

types of web 2.0 tools can be offered to prospective teachers. This study was conducted with the participation of prospective elementary school teachers. Applied studies with web 2.0 tools can be conducted in courses such as science teaching, mathematics teaching, Turkish teaching, social studies teaching and so on with the participation of prospective teachers of differing branches. Applied examples can be included in relation to prospective teachers' content knowledge, pedagogical knowledge and technological knowledge in their own areas. Experimental studies on attitudes, motivation and retention in learning beside self-efficacy could also be designed. It might be recommended that prospective teachers keep contact with university and receive support from lecturers after they become teachers and that Ministry of National Education offer in-service training and seminars in this respect. Cooperation between provincial directorates of national education and universities have been increasing in recent years. Similar studies concerning technology integration could also be conducted with the participation of practising teachers. Teachers can be offered applied education considering their needs especially in seminars and thus seminars can be more efficient and education on technological pedagogical content knowledge- which may be lacking- can be offered.

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