The experiences of biology education master students in web 2.0 content development

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Article Info	Abstract
	In this study, the effect of the activities carried out via Web 2.0 tools on the biology education master students' content development self-efficacy beliefs and students' views were examined. The mixed model was used in the study. The study group consisted of 15 students who took the course "Web Supported Material Design in Biology Teaching" in the last three years in the Master's program of Biology Education of a public university in Turkey. The data of the research were obtained through the "Web 2.0 Fast Content Development Self-Efficacy Belief Scale" and an interview form containing 5 open-ended questions. During the implementation process, students developed content with eight web 2.0 tools (Camtasia Studio, Prezi, Thinglink, etc.). As a result of the implementation, it was seen that the self-efficacy belief levels of the students increased. When the students' views were examined, the advantages of web 2.0 tools such as being interesting and entertaining, increasing retention in learning and providing rich content came to the fore. Regarding the limitations of these tools, issues such as lack of internet connection and hardware, technical problems, high cost and time management are highlighted. In addition, suggestions for the effective use of Web 2.0 tools in biology teaching, experiences in daily/business life and views about their favourite tools are also included.

1. Introduction

Today, new technologies are widely used in educational settings, as well as in all fields. With these new technologies, information can be easily presented to any environment and everyone by getting out of restricted areas. People now have the opportunity to become not only consumers of information but also producers in virtual environments (Çelik, 2019; Telli Yamamoto & Karamanlı Şekeroğlu, 2014). Web 2.0 is a concept that emerged in parallel with the development of internet technology, defining various, interactive and collaborative aspects of the internet. Web 2.0 represents the 2nd generation web pages that facilitate communication and collaboration on the internet (Alexander, 2006).

O'Reilly (2007) defined the concept of web 2.0 as "Tools that allow users to communicate and interact on the web". While Web 1.0, which is the first stage of web technology, is a one-way information flow; Web 2.0 includes user-specific interfaces and connecting people through social networks. Web 1.0 only allows reading, sharing and accessing information. On the other hand, Web 2.0 applications allow both reading and writing, interaction and communication with people (Shivalingaiah & Naik, 2008). In short, Web 1.0

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technology provides users with ready-made content and makes them passive readers, while Web 2.0 applications enable users to collaborate and produce shared content (Keskin, 2021).

The logic of the change in Web 2.0 technologies, which is defined as the 2nd generation Web environment, can be attributed to the fact that users have the opportunity to collaborate more frequently and in real-time (Hulburt, 2008; Hung & Yuen, 2010; Song, 2010). As with all new technologies, Web 2.0 tools were quickly adopted as a new way in all areas that require communication and interaction. The rapid spread of Web 2.0 technologies can be attributed to the advantages such as providing opportunities for individuals to develop content, social interaction and sharing without the need for technical knowledge. (Conole & Alevizou, 2010; McLeod & Vasinda, 2008).

Virtual environments called Web 2.0 tools, serve different purposes. Blogs, wikis, multimedia sharing sites, podcasts, social networks, bookmarking sites and instant messaging tools are Web 2.0 technology-based environments (Anderson, 2007). Web 2.0 tools in educational environments are used by downloading applications to devices such as computers, phones and tablets via the internet. While Web 2.0 tools spread in many areas, there are also a wide variety of applications in education. These applications are diversified according to their usage areas. These can be classified as follows; lecture videos, data storage applications, digital storytelling tools, concept map and drawing tools, word cloud, presentation tools, animation and video creation applications, online boards, virtual classroom applications and evaluation tools. These applications are updated and more functional every day (Sarı, 2019).

Franklin and Harmelen (2007) stated that Web 2.0 would have important implications for students and teachers in formal, informal, work-based and lifelong education. Because most of the students frequently use these technologies in their daily lives. The emergence of Web 2.0 technologies has changed the way students interact and learn new information (Harper, 2012). Therefore, students now need to be creative thinkers, problem solvers and technology literate individuals in order to not only understand the given content but also be active. Therefore, integrating these technologies into education will positively affect the learning process (Fırat, 2015; Kale, 2013).

Many advantages of Web 2.0 technologies to the teaching process have been mentioned in the literature (Ajjan & Hartshorne, 2008; Conole & Alevizou, 2010; Demirkan, 2019; Grosseck, 2009; Livingstone, 2015; O'Reilly, 2007; Punie, Zinnbauer & Cabrera, 2006; Ünlüer, 2018).

- It eliminates time constraints and enables learning at an individual pace, by providing a more flexible learning environment.

- Students who use different web 2.0 tools become more active in the lesson.

- It can develop higher order thinking skills.

- Students can work in groups while creating products, increasing their sociability.

- It is interesting and increases motivation.

- It makes the learning process more fun.

- It helps to form a sense of individual responsibility and community.

- It provides concretization by addressing more sense organs in lessons.

In addition to all these advantages; it is also stated that there may be disadvantages such as technical support and hardware requirement, time consuming, concerns about data security, negative attitudes and beliefs of teachers and students towards web 2.0 tools (An et al., 2009; Grosseck, 2009; Özkılıç, 2021; Yükseltürk & Top, 2016).

One of the areas where Web 2.0 technologies are effective is biology. Biology is complicated to teach and learn as it involves complex relationships of abstract concepts. This situation leads to the fact that

students have difficulty understanding some subjects and learn them by memorizing without understanding (Kılıç & Sağlam, 2004). Well-crafted illustrations, 3D models, animations, etc. provide an easier understanding of the targeted information (Çömlekçioğlu & Bayraktaroğlu, 2001). These environments can be created effectively with Web 2.0 tools.

The necessity of students' self-efficacy in e-learning environments is one of the difficulties encountered in practice (Graham, 2006). Self-efficacy is an effective quality in forming behaviours and is defined as "an individual's self-judgment about her/his ability to organize and successfully perform the activities necessary to show a certain performance" (Bandura, 1997). Bandura (1997) emphasizes that the self-efficacy belief affects an individual's behaviour doing right or wrong activities and a sign of how much effort an individual will make to solve it when faced with a problem and how persistent they will be.

While Pan and Franklin (2011) emphasize that teachers' self-efficacy is an essential factor in the effective use of Web 2.0 technologies in learning environments, they state that if a teacher does not trust their abilities, the probability of failing to use Web 2.0 tools in their lessons is high. To develop technology use skills, self-efficacy beliefs should be developed first. It is thought that content development self-efficacy belief is one of the most critical issues to improve teachers' techno-pedagogical content knowledge (TPACK) skills. At this point, it is important that pre-service teachers and teachers, who are one of the essential sharers of technology integration processes, experience the use of technology and develop their self-efficacy beliefs in this way (Gürsoy & Göksün, 2019). In this context, it is thought that the study will contribute to the literature.

This study aimed to enable master students, most of whom work as biology teachers, to experience content development using Web 2.0 tools and investigate the effect of content development with Web 2.0 tools on their self-efficacy. For this purpose, answers to the following questions were sought:

- Do the activities carried out affect master students' Web 2.0 content development self-efficacy beliefs?

- What are the views of master students about the activities?

2. Methodology

2.1. Research Model

A mixed model was used in the research. According to Creswell and Clark (2007), a mixed model is an approach that includes the use of qualitative and quantitative methods together. Using these methods together provides a better understanding of the research problem than each method alone.

2.2. Study Group

The study group of the research consisted of 15 students who took the "Web Supported Material Design in Biology Teaching" course in the last three years in the Biology Education Master's Program of a state university. Of these 15 students, 11 are women and 4 are men. 11 of them work as biology teachers, 2 of them work in the health sector, and the other 2 are waiting to be appointed as teachers.

2.3. Data Collecting Tools

The research data were obtained through the " Web 2.0 Fast Content Development Self-Efficacy Belief (W2FCDSEB) Scale " developed by Birişçi et al. (2018) and an interview form containing five open-ended questions.

Web 2.0 Fast Content Development Self-Efficacy Belief (W2FCDSEB) Scale

The scale consists of 21 items under three factors (preparation, presentation and evaluation). On a scale; 5-point Likert-type rating was used: I am very adequate (5), I am adequate (4), I am moderately adequate (3), I am inadequate (2), and I am very inadequate (1). There is no negative item on the scale. The highest possible score is 105 and the lowest score is 21. According to the average score values obtained from the

scale; self-efficacy belief levels of individuals; the score below 2.6 was classified as low, between 2.6-3.4 as moderate, and above 3.4 as high. The Cronbach Alpha reliability coefficient for the overall scale was determined as .95. The Cronbach Alpha reliability coefficients of the sub-dimensions were calculated as .93 for "Preparation", .85 for "Presentation" and .84 for "Assessment". The calculated reliability coefficients show that the scale's reliability is high. In this study, it was found to be .88 for the overall scale.

Interview form

The interview form includes 5 open-ended questions. These questions are as follows:

- What do you think are the positive aspects of using Web 2.0 tools in the lesson? Why?

- What do you think are the negative aspects of using Web 2.0 tools in the lesson? Why?

- What are your suggestions for the effective use of Web 2.0 tools in biology teaching?

- Do you use Web 2.0 tools in your daily/business life? Tell me about your experiences.

- Which were your favourite Web 2.0 applications? Can you write with your reasons?

2.4. Data Analysis

Quantitative data obtained from the study were analysed with the Wilcoxon signed-rank test, which is the nonparametric equivalent of the paired samples t-test, using SPSS 20 software. Also, the content analysis method was used to analyse qualitative data. The primary purpose of content analysis is to reach the concepts and relationships that enable the explanation of the collected data (Yıldırım & Şimşek, 2011). The data obtained were analysed using the NVivo 11.0 software and evaluated within the framework of themes.

2.5. Research Procedures

The implementation was carried out in the fall semester within the scope of the "Web supported material design in biology teaching" course in the Biology education master's program. The aim of this course; is to develop students' web-supported material design skills and to apply them in biology teaching. Within the scope of the course, eight web 2.0 tools were taught for 16 weeks. Students also developed content suitable for biology teaching with these web 2.0 tools. Web 2.0 tools and the implementation schedule are given in table1.

Table 1.

The Implementation Schedule

Week	Web 2.0 Tool	Aim
1-2	Camtasia Studio	Preparing a lecture video
3-4	Exe Learning	Creating a lesson page
5-6	Prezi	Preparing a presentation
7-8	Google forms	Creating and administering a survey
9-10	Kahoot	Creating a quiz
11-12	QR Code	Preparing QR code supported worksheet
13-14	Thinglink	Creating interactive visuals
15-16	Powtoon	Create animation

Camtasia Studio

Camtasia Studio is a tool for creating video-based content with its screen recorder and video editor features. The prevalence of video-based content in today's educational environments reveals the importance of Camtasia Studio (TechSmith, 2018). In this study, the students recorded the screen while presenting the lesson and turned it into a video (Picture 1).
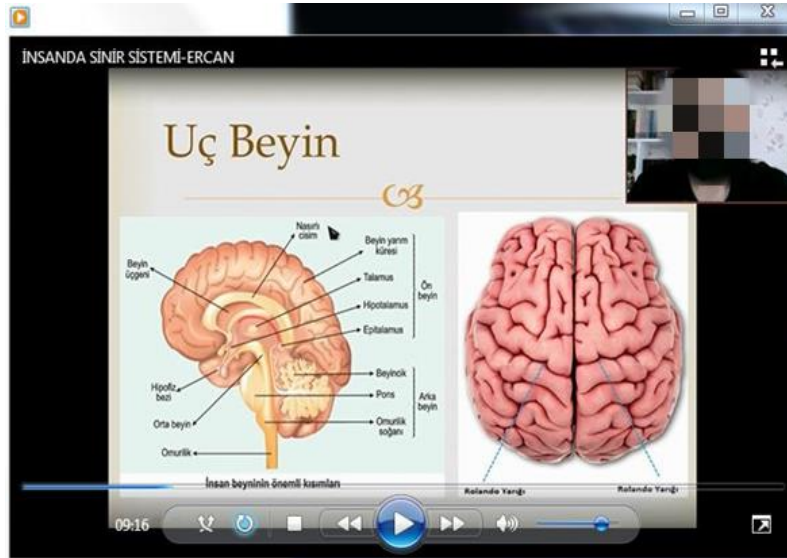
Picture 1. Sample Camtasia Studio content screenshot

Exe Learning

eXe Learning is an XHTML editor. It is available for free online. Some versions can run under Windows, Linux and Mac OS. It works based on Firefox. With this editor, a SCORM package, IMS (Instructional Management System) content package that can be run on a website or LMS environment or a material that can run on an iPod can be easily prepared. Many active objects that can enrich the course content, such as pictures, flash videos, tables can be placed in the content you want to prepare. The working logic of the editor is easily understandable and does not pose any difficulty for an educator who wants to prepare content; it is easy to use, the user interface is designed to facilitate this (Arslan, 2013). In this study, the students prepared a course page containing content such as a subject summary, multimedia tools, true-false, fill in the blanks, and test questions (Picture 2).


Picture 2. Sample eXe Learning content screenshot

Prezi

Prezi is one of the applications used to create digital presentations. Prezi allows making linear or free flow presentations by the subject content (Türker & Pala, 2018). Like other presentation tools, it allows additional editing such as text, video, audio tool, images. Prezi also allows seeing the subject entirely or

in parts adding a special zoom in/out feature to the scenes (Kırbaş, 2021). In this study, students prepared presentations on biology (Picture 3).
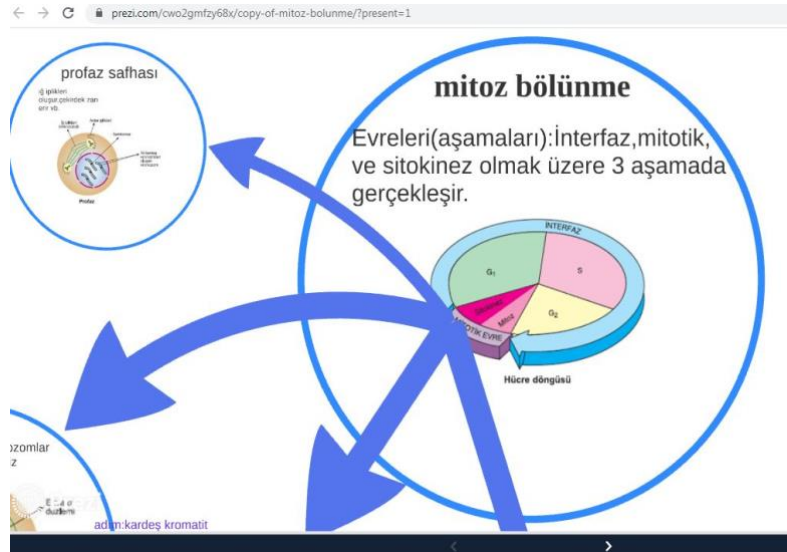
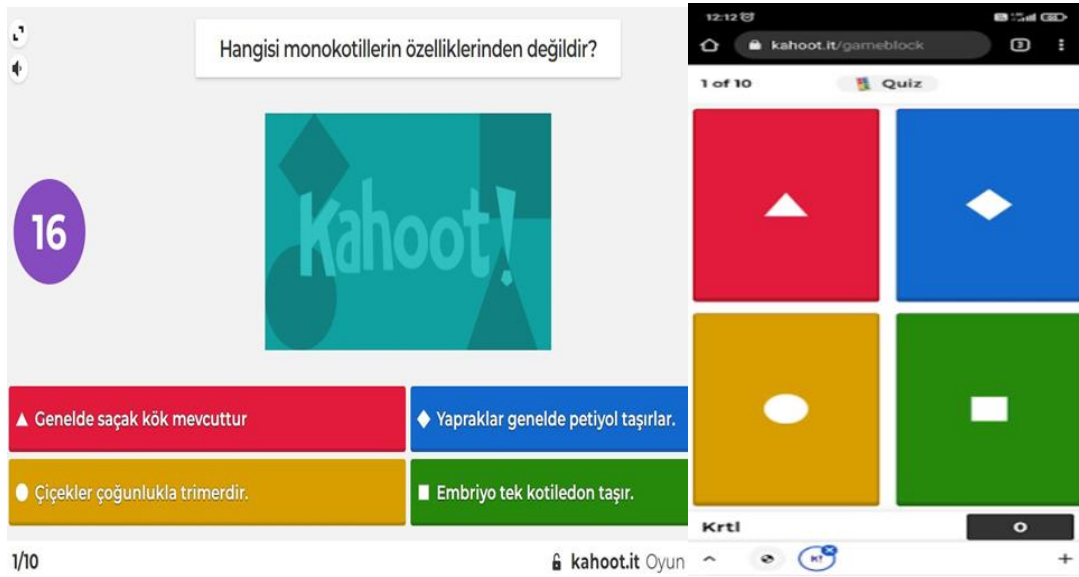**Picture 3.** Sample Prezi content screenshot

Google Forms

Google forms, one of the survey preparation tools; is a network-based application frequently used in the academic field. It is straightforward to use and includes many templates suitable for the survey or exam

drafts you want to prepare. Surveys or exams can be prepared using these templates (Kırbaş, 2021). The data of the applied surveys are automatically transferred to the excel file. This provides excellent convenience for data collection and analysis. In this study, students prepared and applied a questionnaire and prepared the data for analysis (Picture 4).

Picture 4. Sample Google Forms content screenshot

Kahoot

Kahoot is an application for preparing a small contest, survey or quiz on the Web. It is enough to be a member for free to prepare a competition or quiz through the application. Participants do not need to register. The competitor can enter the code given for the created competition (Benzer, 2009). The content,

format and number of questions of the prepared competition are entirely dependent on the author and can add diagrams, tables and visuals to the questions prepared (Dellos, 2015; Can, 2021). The questions are shown via smartboard or computer. Answers are made via mobile devices. In this study, students prepared and applied a quiz (Picture 5).

Picture 5. Sample Kahoot content screenshot

QR Code

QR code is a type of two-dimensional barcode decoded with mobile devices' cameras (Ramsden, 2008). By storing information in horizontal and vertical directions, QR codes can be read in both directions with locators (Law & So, 2010). Thanks to QR code technology with mobile devices, it is possible to connect to a web address and access explanations (Çelik, 2012). In this study, students prepared worksheets supported by QR codes (Picture 6).
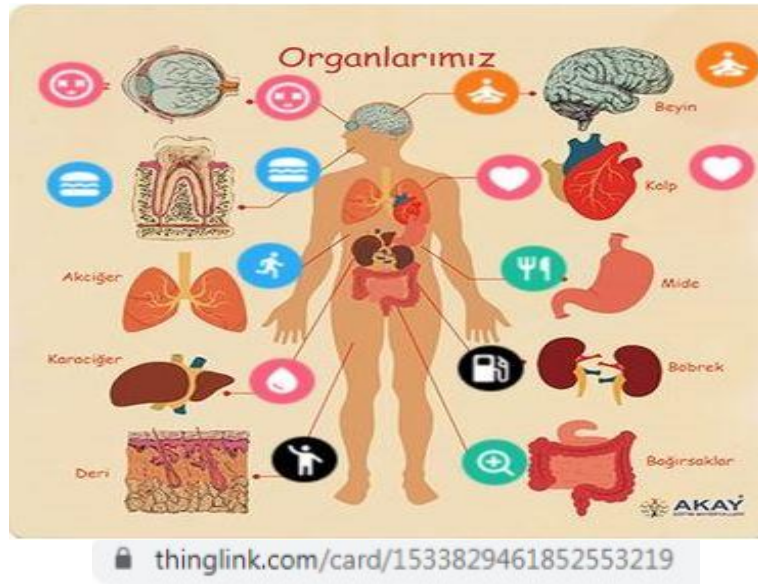

Picture 6. Sample QR Code content screenshot

Thinglink

Thinglink is an interactive visual creation tool. It allows adding maps, quizzes, charts, videos, calendars and data via interactive stickers on images. After the images are uploaded to the application, the stickers are placed in the necessary places, allowing students to access additional information when they click on

these labels. Thinglink is very suitable for use in the distance education process (Yalçın, 2022). In this study, students created interactive visuals (Picture 7).

Picture 7. Sample Tniglink content screenshot

Powtoon

It is a presentation creation tool supported by animations. In the application, as in other applications, you can add elements such as text, audio, visuals, and you can benefit from the animated content in its content. Powtoon, which is used with paid and free versions, is an effective web 2.0 tool for producing content using a blank draft or ready-made animation templates for presentations (Türker & Pala, 2018). In this study, students prepared presentations using animations (Picture 8).
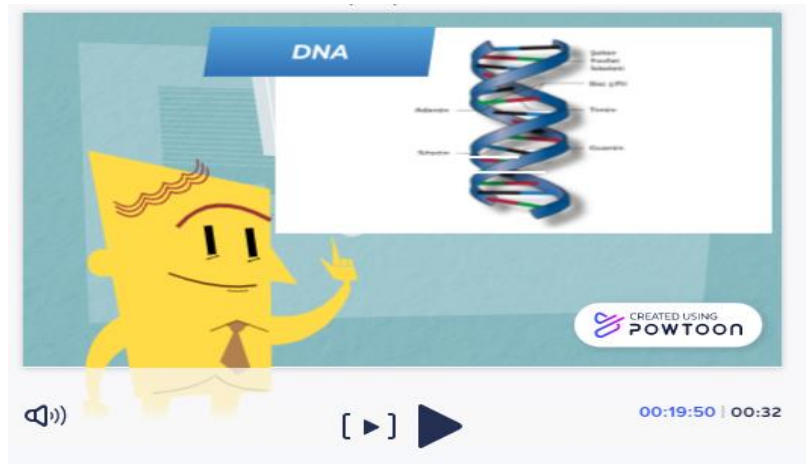
Picture 8. Sample Powtoon content screenshot

3. Findings

3.1. Findings obtained via the W2FCDSEB scale

Table 2 presents the pretest-posttest mean scores and standard deviation values obtained by the students participating in the study from the Web 2.0 Fast Content Development Self-Efficacy Belief (W2FCDSEB) Scale.

Table 2.

Statistical Results Regarding the W2FCDSEB Scale Pretest and Posttest Scores

	n	$\bar{X}$	SD	Min	Max
Pretest	15	2,30	0,79	1,67	4,00
Posttest	15	4,28	0,32	3,76	4,95

Table 2 presents the pretest-posttest mean scores and standard deviation values of the students participating in the study. In the table, it is seen that the pre-test mean score of the students is 2.30, and the post-test mean score is 4.28. According to the Birişçi et al. (2018) classifications, the pre-test means the score is in the "low" category, while the post-test mean score is in the "high" category.

The Wilcoxon signed-rank test results regarding the pretest-posttest mean scores obtained by the students from the W2FCDSEB Scale are shown in Table 3.

Table 3.

Wilcoxon Signed Ranks Test Results Regarding the W2FCDSEB Scale Pretest and Posttest Scores

	Posttest-pretest	n	Mean Rank	Sum of Ranks	z	p
Self-efficacy	Negative rank	0	0	0	-3,408*	,001
	Positive rank	15	8,00	120,00		
	Equal	0				
	Total	15				

*Based on negative ranks

According to the test results presented in Table 3, there was a significant difference between the students' W2FCDSEB scale pretest and post-test mean scores (p<,05). Considering the rank totals of the difference scores, the difference was found to be in favour of the positive ranks for the posttest score. Depending on these findings, it could be stated that the activities carried out increased the students' Web 2.0 Fast Content Development Self-Efficacy levels.

3.2. Findings obtained via the interview form

Positive Aspects

The codes obtained from the students' views on the positive aspects of Web 2.0 tools are given in Table 4.

Table 4.

Codes related to positive views of students towards Web 2.0 tools

Codes	f
Interesting	8
Entertaining	6
Increasing retention in learning	4
Providing rich content	4
Active participation in the lesson	3
Provides an opportunity for subject repetition	2
Interacting	2
Enhancing technology literacy	2
Time-saving opportunity	1
Providing easy access to resources	1
Improving cooperation	1

As seen in Table 4, when the positive views about Web 2.0 tools were examined, it was determined that the students mostly emphasized that Web 2.0 tools were interesting and entertaining. Regarding the issue, student A2 states that; "*Web 2.0 tools are interesting and so entertaining. I think we can attract students' attention by using these tools in our lessons.*" Another issue that students mostly agree with is that Web

2.0 tools increase the retention in learning and provide rich content. Student A8 states that; "*These tools provide more permanent learning because they appeal to more than one sense organ*"; also, A6 states, "*It is possible to create richer content about the subjects with different tools*". In addition, it can be said that it provides active participation in the lesson and the opportunity to repeat the subject as its essential advantages. Student A12 states that related to this issue; "*With web 2.0 tools, students can step out of the passive role and take an active role in the lesson*". Also student A9 states that; "*With Web 2.0 tools, it is possible to repeat the subjects without the time and place limits*". Other positive aspects are stated as "interaction", "enhancing technology literacy", "time-saving opportunity", "providing easy access to resources" and "improving cooperation".

Negative Aspects

The codes obtained from the students' views on the negative aspects of Web 2.0 tools are given in Table 5.

Table 5.

Codes related to negative views of students towards Web 2.0 tools

Codes	f
Requiring internet connection-connection problems	**9**
Requiring technological equipment (mobile devices, pc)	**5**
Technical problems (power outage, etc.)	**2**
High cost	**2**
Time management	**2**
Insufficient technology literacy of the instructor/student	**1**
Poor organization of the content	**1**

When the views on the negative aspects of Web 2.0 tools are examined, it is seen that the students mostly emphasize the need for internet connection and technological equipment to create Web 2.0 tools, and also internet connection problems and technical problems come to the fore. Regarding the subject, student A14 states that; "*Students with low economic opportunities cannot benefit from these tools sufficiently outside of the school because they do not have the required technological equipment*". Also, A5 states that; "*Internet connection problems, etc. technical problems can occur when using Web 2.0 tools during class. This can also distract students*". The students mentioned other important issues are "time management" and "high cost". Regarding the issue, student A9 states that "*Although Web 2.0 tools are easy to use, they can be time-consuming to learn and implement. This can cause problems in time management*". Also A1 states that "*The hardware and software required to perform these activities can be costly for both the school and the students*". In addition; limitations such as the insufficient technology literacy of the instructor and the student, and the poor organization of the content were also mentioned.

Suggestions for Effective use

The codes obtained from the students' suggestions regarding the effective use of Web 2.0 tools in biology teaching are given in Table 6.

Table 6.

Codes for students' suggestions for the effective use of Web 2.0 tools in biology teaching

Codes	f
Training teachers on Web 2.0 tools	**4**
Improving technological infrastructure in schools	**4**
Being active of the students	**3**
Paying attention to time management	**2**
Planned implementation	**1**
Preparing for the gains	**1**

As seen in Table 6, when the suggestions for the effective use of Web 2.0 tools in biology teaching are examined, the students mostly emphasized that the teachers should be informed and trained about web 2.0 tools and the technical deficiencies in schools should be improved. Regarding the issue, student A4 states that; "*Especially in courses where abstract concepts are abundant such as biology, Web 2.0 tools are essential for the concretisation of these concepts. I think that teachers should be informed about the advantages and use of these tools and trained through in-service training. We would not have been able to use these tools effectively if we had not learned in this lesson*". Regarding the technological infrastructure deficiencies, student A 14 states that; "*Technological infrastructures in schools are not suitable for today's technology age. If we want such practices to be effective, these deficiencies must be eliminated first*". It was emphasized as another critical issue that students should actively use these tools. Regarding the issue, student A7 states that; "*If we want these tools to be more effective in teaching, not only teachers should use them; students should also use it actively with activities such as homework and preparing presentations. Thus, they can provide more permanent learning by being involved in the process*". Regarding the issue of paying attention to time management, A9 said that; *"Although these activities provide many advantages, they force teachers in time management. Therefore, it is necessary to pay attention to this issue while making a lesson plan"*. Moreover; it is suggested that these activities should be prepared by the gains and implemented in a planned manner.

Using Web 2.0 tools in daily/business life

Most of the master students whose views were taken work as biology teachers. They stated that they use social media tools effectively in their daily life, and they started to use the Web 2.0 tools learned in this lesson effectively in their business life. Regarding the issue, student A7 states that; "I try to use the Web 2.0 tools we learned in the lesson by the subject. I prepare and share question/solution videos with Camtasia. I can create engaging presentations with Prezi. Applications like these attract students' attention". A6 states that: "At the end of the unit, I create and apply quizzes for assessment. Thus, I get feedback and create an entertaining environment for students". Also, A12 said that; "I am trying to prepare videos and presentations suitable for the goals. In addition, the materials I developed with QR support attract a lot of attention."

Favourite Web 2.0 Tools

The codes obtained from the students' views on the favourite Web 2.0 tools are given in Table 7.

Table 7.

Codes related to favourite Web 2.0 tools

Codes	f
Thinglink	3
Google Forms	2
Kahoot	2
Camtasia	2
QR	2
Prezi	2
Powtoon	1
Exe Learning	1

Students generally stated that they found all the Web 2.0 tools helpful. Although there are similar frequencies, we can say that the "thinglink" is the most popular. Regarding the issue, student A2 states that; "*We created interactive visuals with Thinglink. It provided the opportunity to show all aspects of the subject with different media tools through a single picture. For example, in the human body image I prepared, I was able to explain the names and functions of the organs, both in writing and with animations and videos, on a single image*". Moreover; "Google forms" for creating online surveys and collaborating on documents; "Camtasia" with the preparation of lecture and question-solving videos;

"Kahoot", which provides entertaining feedback at the end of the topic; "Prezi", which allows getting rid of the monotony of classical presentations; "QR code", which provide easy access to content that does not fit on the pages, is also famous for the reasons stated.

4. Conclusion and Discussion

According to the findings obtained in the study, it is seen that there is a significant difference (p< ,05) between the W2FCDSEB Scale pretest-posttest scores of the students in favour of the posttest. Consequently; it can be said that the students' Web 2.0 content development self-efficacy levels increased after the application process. The average scores of the students reached from "low (2.30)" to "high (4.28)". The students' views also support this. Similarly; Gürsoy and Göksün (2019) investigated pre-service teachers' experiences in content development by using Web 2.0 tools and the effects of these experiences on their content development self-efficacy beliefs. Within the scope of the research, 42 pre-service science teachers developed content using Web 2.0 tools such as Kahoot, Quizizz, Powtoon, Emaze, MindMeister, Toondoo and Edmodo. As a result of the research, it was seen that content development with Web 2.0 tools had a positive effect on the self-efficacy beliefs of pre-service science teachers. Akkaya (2019), in his master's thesis titled "The Effect of Activities Developed with Web 2.0 Tools on Students' Achievement on Computer Hardware Subject "; he tried to determine the effects of activities developed with Web 2.0 tools on students' academic achievement, attitudes towards computers, their Web 2.0 fast content development self-efficacy levels, and students' views on the implementation process. As a result of the research, it was determined that Web 2.0 applications positively affected students' attitudes towards computers, their Web 2.0 fast content development self-efficacy levels, and academic achievement. Pan and Franklin (2011) reported that teachers' self-efficacy and professional development affect the use of Web 2.0 tools. In a study by Ward (2015), it was shown that there is a strong positive correlation between self-efficacy beliefs and the use of Web 2.0 tools in the classroom. As a result, it is understood from the students' views that with the improvement of their Web 2.0 content development self-efficacy, they began to use these tools more effectively and willingly in classrooms.

When the students' views were examined, the positive aspects of web 2.0 tools such as being interesting and entertaining, increasing retention in learning, providing rich content and active participation in the lesson came to the fore. Besides these; it has also been stated that it has advantages such as providing the opportunity to repeat the subject, increasing interaction, enhancing technology literacy, saving time, providing easy access to resources and developing cooperation. The studies reflecting similar results have been found in the literature. Ünal and Uzun (2018), in their study with 54 pre-service teachers, investigated their intention to use Web 2.0 tools when they started their profession. According to the interviews, pre-service teachers stated that they would like to use Web 2.0 tools in the future because of their advantages such as being attractive, facilitating learning, saving time, ease of access, and increasing motivation. Korucu and Sezer (2016), in their study titled "Teachers' views on the effect of the using frequency of Web 2.0 technologies on the academic achievement", stated that teachers mostly use Web 2.0 tools for educational purposes. Also they stated that; these applications had achieved results such as encouraging students to work collaboratively, providing concretization, facilitating access to information, and enabling active participation. Sadaf (2013) collected data through a questionnaire applied to 189 pre-service teachers and semi-structured interviews with 12 pre-service teachers. According to the analysis, pre-service teachers stated that Web 2.0 technologies are beneficial in improving students' learning experiences by using student participation, interaction, communication and innovative learning tools. Gürsoy and Göksün (2019) in their study; stated that the pre-service teachers emphasized the advantages of Web 2.0 tools such as being quite entertaining, improving their technology literacy and providing more retention in learning. These results; support the results of the study. Apart from these advantages of Web 2.0 tools, some studies express different advantages. Korucu (2020), in the study he carried out with 39 pre-service biology teachers, determined that the academic achievement, numerical competencies, and inquiry skills of the pre-service teachers who use the digital story development environment are supported by web 2.0 applications have increased. In the study carried out by Aytan and Başal (2015), pre-service

teachers state that web 2.0 tools improve their critical thinking skills, student-teacher feedback process and creativity power.

Considering the views of the master students about the negative aspects of the Web 2.0 tools; it is mostly emphasized that; the need for internet connection and technological equipment (smartphone, tablet) and technical problems such as connection problems negatively affect the process. Also; disadvantages such as high cost, time management problems, insufficient technology literacy of the instructor and student, and poor content organization were also emphasized. It is seen that there are studies similar to these results in the literature. Chawinga and Zinn (2016) examined Information Science and Communication Faculty students' aims of using web 2.0 applications and the factors affecting the use of Web 2.0 applications in their study. In addition to the positive views obtained, it was also found that the lack of an internet connection makes it difficult to adopt web 2.0 applications. In the study conducted by Gürsoy and Göksün (2019), the themes emerged when pre-service teachers' views were analysed; disadvantages such as infrastructure problems, language problems, and prejudice stand out. In addition, Ünal and Uzun (2018) stated that the pre-service teachers do not want to use some web 2.0 tools due to their limitations such as the English language and complex interface.

When the suggestions for the effective use of Web 2.0 tools in biology teaching are examined, the students mostly emphasized that the teachers should be informed and trained about web 2.0 tools and the technical deficiencies in schools should be improved. Besides these; suggestions such as ensuring the active participation of the students in the process, paying attention to time management, applying web 2.0 tools by the gains and in a planned manner were also presented. Mason (2016) made the following suggestions in his study; choosing shared web 2.0 technologies to be used throughout the university; additional training of faculty staff and students; modelling the use of web 2.0 technologies throughout the university. Özer and Albayrak Özer (2017) stated that pre-service teachers are partially aware of the features of Web 2.0, they want to use Web 2.0 tools in education, but their knowledge on this subject is not sufficient. Also, they emphasized the importance of introducing Web 2.0 tools to teachers. On the other hand, Ranger and Land (2017) suggested in-service training by instructional technology experts to support the professional development of trainers who want to integrate Web 2.0 tools into their courses (cited by Gürsoy and Göksün, 2019).

In addition, master students expressed their experiences using Web 2.0 tools in their daily/business lives. It has been stated that web 2.0 tools, especially social media tools, provide convenience in their daily lives. Master students working as biology teachers stated that they now use web 2.0 tools more actively in their lessons thanks to the experience they have gained. Their students are also delighted. When we examine the views of master students about their favourite web 2.0 tools, it is seen that the preferences are similar to each other. The many valuable features of these tools may mean that they are generally adopted.

It has been stated that such innovative practices can meet the needs and wishes of 21st-century students and produce innovative solutions to existing pedagogical problems (Deterding et al., 2011; Zicherman & Cunningham, 2011). Therefore, the effective use of such approaches in lessons is significantly related to teacher self-efficacy. The development of these competencies can be achieved with the experience gained. It can be said that the study carried out in this context is valuable for the widespread use of web 2.0 tools in biology teaching.

5. Suggestions

In the light of the findings, the following suggestions can be made:

- Considering the positive results obtained, it can be suggested to include these tools in appropriate courses and subjects.

- Technological equipment deficiencies of schools should be eliminated by taking measures to minimize the technical problems that may occur.

- It is strongly recommended that prospective teachers be informed and trained about Web 2.0 tools through in-service training.

- Teachers should ensure that students actively participate in the process by paying attention to the goals and time management during the implementation process.

- The effects of different Web 2.0 tools on academic achievement, attitude and motivation can be investigated.

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