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Pre-Service Science Teachers' Views on Technology-Supported Conceptual Change Activities

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ABSTRACT

The aim of the research is to determine the pre-service science teachers' views related to technology-supported conceptual change activities. The research is a qualitative descriptive study. Five out of ten pre-service science teachers who participated in technology-supported conceptual change activities were included in the research. The pre-service teachers were firstly informed about the conceptual change activities online, and then they were provided with the opportunity to create technology-supported activities within the scope of the 2018 Science Curriculum. The pre-service science teachers used the "Inspiration" software for concept maps, the "MindManager" software for mind maps, and the "Powtoon" website for concept cartoons and conceptual change texts. Semi-structured online interviews were conducted with the five pre-service science teachers. The interviews were recorded after obtaining the consent of the pre-service teachers. The analysis of the data was carried out based on content analysis. Codes were created and presented in table format as sub-themes based on the responses of the pre-service science teachers. It was concluded that the pre-service science teachers had positive views about conceptual change activities.

Keywords:
Conceptual change, technology, pre-service teacher, interview, science education

1. Introduction

The quality of teaching and supporting it with different methods and techniques is very important in terms of achieving meaningful and permanent learning. Considering the current century and the pandemic process that has affected Turkey and the world since 2020, it has become a necessity for teachers to receive training on the use of technology in education. In Turkey, different methods and techniques have been used in education in order to both adapt to developing technology and improve education and to aim to get rid of the COVID-19 pandemic conditions, which have been felt all over the world, with less impact. Technology in education should not be a goal for teaching but a tool to help (Girginer & Özkul, 2004). The technology to be used in education should not be in a position to overshadow teaching but should be at a level that will support the course and contribute to students' learning. In addition, in the classification of 21st century skills according to P21 (Partnership for 21st Century Learning, 2009), technology literacy is included in information, media, and technology skills (Larson & Miller, 2011). It can be mentioned that the technology that can be used for this purpose can also be useful in "basic competencies in science and technology" and "digital competence" in the competencies section of the 2018 Science Curriculum in Turkey.

The 2018 Science Curriculum aims for a teaching environment where individual differences are taken into account and teachers guide the learning process. Science is a course that includes many abstract subjects and

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concepts. There are some security problems and limitations in observing or applying these concepts in daily life (Çelik & Karamustafaoğlu, 2016). Technology-supported conceptual change practices are practices that take into account the individual differences of students and support the integration of technology into education. Concept-based applications are used to facilitate conceptual change, identify or remove misconceptions, and achieve various objectives. Conceptual change is defined as the replacement or organization of existing and incorrect knowledge in the mind of an individual with correct scientific knowledge (Asterhan & Resnick, 2019; Çaycı, 2018; Çepni & Çil, 2010). Conceptual change texts, concept maps, mind maps, analogies, models, and concept cartoons are among the tools that support conceptual change. Conceptual change texts are texts that enable students to realize that the information in their minds is misunderstood, explain the reasons why the existing concepts are wrong, and make them feel that their current learning is insufficient in solving the problems they will encounter (Çelikkaya & Şarlayan, 2019). Concept maps are visual tools that demonstrate complex relationships between concepts in a subject and their integration with each other in a hierarchical structure (Tsai et al., 2001; Williams, 2008; Wilson et al., 2016). Mind maps are graphic materials created with colors, visuals, key concepts, and brief explanations based on the detailed correlation of concepts and sub-concepts related to a topic, utilizing the simultaneous use of the brain's right and left lobes (Balım et al., 2011). Concept cartoons, which contain at least three cartoons presenting different scientific information, are used in education to identify and eliminate misconceptions in students (Atasoy et al., 2013; Naylor & Keogh, 2012).

It is very important for pre-service teachers to receive training on how to teach basic concepts and how to identify and eliminate misconceptions, which constitute a major problem. Tütüncü (2022) stated that it is important to intensify interactive content in distance education in order to reach learning outcomes and identify misconceptions. Especially for today's education system, where contemporary education understanding is gaining more importance, it is an important necessity to train teachers who can provide a learning environment in the classroom in line with the needs of the 21st century. In computer and technology-supported studies conducted with pre-service teachers, it has been stated that there is a relationship between their self-efficacy and their use of technology (Çelik & Karamustafaoğlu, 2016); there is a relationship between information literacy and computer literacy (Akkoyunlu & Kurbanoğlu, 2003); they are inadequate in using basic computer applications (Fisher, 2000; Tünkler, 2021); they are inadequate in using the internet and computer for teaching purposes (Erdemir et al., 2009). In other studies, pre-service teachers stated that there should be online applications (Jowallah, 2008) and that traditional education can be improved with computer and technology support (Rutten et al., 2012). Girginer and Özkul (2004) stated that technology in education is not only used for teaching but also serves many different purposes, such as planning, presenting, and evaluating the educational process by teachers. Kim et al. (2007) stated that technological tools have benefits such as supporting careful inquiry and research, providing opportunities for structuring and revision, and providing a collaborative learning environment for learning scientific knowledge. Courses using computers or technology provide an interactive learning environment by helping students organize, combine, and code their own knowledge (Akçay et al., 2005).

Technology affects all societies in many areas, such as the economy, politics, education, and social life (Bacanak et al., 2003). In this case, the use of technology as a tool in education is inevitable. Teachers, who are responsible for the implementation of the education and training process, have a lot of work to do with the active use of technology. Pre-service teachers' self-confidence and attitudes towards using technology in their profession affect their integration of technology into education and students' achievement (Christance, 2002). Teachers, who are the implementers of curricula in schools all over the world, need to be equipped with the knowledge, skills, and attitudes towards contemporary education and be able to transfer them (Özmen, 2004). Pre-service teachers, who are the guides of students, should also be trained and equipped for this purpose. It is thought that having pre-service teachers prepare conceptual change activities, which are especially important for science education, with the support of technology by using Inspiration and Mind Manager software and the Powtoon Web 2.0 tool will have positive effects on their education and professional lives. Considering the importance of concept teaching and the necessity of integrating technology into education, the aim of the study was to enable pre-service teachers to create technology-supported conceptual change activities and to obtain their opinions about the applications. The problem statement of the research can be expressed as "What are the opinions of pre-service science teachers about the technology-supported conceptual change activities they prepared?".

2. Methodology

2.1.Research Model

This research is a qualitative descriptive study that provides an idea about the current situation. Qualitative descriptive research is a research model that does not aim for any change in the existing situation and aims to determine the situation as it is (Karasar, 2014).

2.2. Participants

The participants of the study consisted of five of the 10 second-year pre-service teachers studying at a university in the Aegean Region in the spring semester of the 2020-2021 academic year, taking the "Misconceptions in Science Teaching" course and performing technology-supported conceptual change activity applications. The course in question is an online elective course, and the study was conducted with pre-service teachers who attend this course continuously. Although there were 26 (21 female, 5 male) pre-service teachers enrolled in and taking the course, technology-supported conceptual change practices were carried out with 10 female pre-service teachers who participated in the course online. In the study, semi-structured interviews were conducted with five volunteer pre-service teachers who were selected among the ten participants according to their competencies (very competent, competent, and insufficient) to prepare technology-supported conceptual change activities.

2.3. Data Collection Tools and Procedure

A semi-structured interview form was used as a data collection tool in the research. By conducting an interview, individuals' experiences, attitudes, thoughts, and mental perceptions about the subject being researched can be obtained (Sönmez & Alacapınar, 2011). The semi-structured interview questions were prepared by the researchers, and the content validity was tried to be ensured by taking the expert opinions of three science educators, faculty members, and a science education PhD student. Necessary corrections were made in line with the experts' suggestions. A semi-structured interview form includes questions to determine the opinions of pre-service teachers about technology-supported concept maps, mind maps, concept cartoons, and conceptual change texts. A pilot interview was conducted with a pre-service teacher in order to determine the comprehensibility of the interview questions and the duration of the interview.

Online technology-supported conceptual change practices with pre-service teachers lasted for 5 weeks (10 course hours). Online courses were carried out with Adobe Connect software. In the first week, pre-service teachers were told about conceptual change and concept teaching. In the second week, concept maps were created using "Inspiration" software. In the third week, mind maps were applied in "Mind Manager" software. In the fourth week, concept cartoons were prepared by using the "Powtoon" web site. In the fifth week, conceptual change text applications were made on the "Powtoon" website.

Within the scope of the online course "Misconceptions in Science Teaching", pre-service teachers individually created technology-supported concept maps, mind maps, concept cartoons, and conceptual change texts for the learning outcomes selected from the 2018 Science Curriculum. The conceptual change activities created by the pre-service teachers were analyzed every week, and their qualifications were discussed. After the technology-supported conceptual change applications, semi-structured interviews were conducted online with five pre-service teachers. Interviews with pre-service teachers were conducted one-on-one via Zoom meeting. The interviews were recorded after obtaining the consent of the pre-service teachers. For validity, the purpose of the interview was explained to the pre-service teachers. It was ensured that the same question was asked of all pre-service teachers in the same way. The interviews with each pre-service teacher lasted 20–25 minutes.

2.4. Data Analysis

The semi-structured interviews were carefully transcribed after being listened to several times. The transcribed interviews were subjected to content analysis by two researchers. Themes and codes were created for each question from the views of the pre-service teachers; examples from the views of the relevant pre-service teachers were included. In order to ensure the reliability of the analyses of the evaluators, the formula "Reliability = (Agreement / (Agreement + Disagreement)) x 100" created by Miles and Huberman (1994) was

used. The reliability of the analyses of semi-structured interviews was calculated at 83%. The interviewed pre-service teachers were given codes as PsT1, PsT2, PsT3, PsT4, and PsT5.

2.5. Ethical

Ethical For this research, the necessary approval was obtained with the decision numbered 07.05.2021/177 of the Muğla Sıtkı Koçman University Social Sciences and Humanities Research Ethics Committee.

3. Findings

The findings obtained from semi-structured interviews conducted with pre-service teachers (PsTs) after the technology-supported conceptual change activity applications are presented in tables.

PsTs' answers to the question "Do you think concept teaching is important in science courses? Why?" is given in Table 1.

Table 1. *Importance of Concept Teaching in Science Courses*

Category	Codes	Pre-service Teachers	Frequency
Meaningful learning	Avoiding misconceptions	PsT1, PsT2, PsT3	3
	Better understanding of the topics	PsT4, PsT5	2
	Showing the relationships between concepts	PsT1	1

According to Table 1, all five PsTs stated that concept teaching is important. The PsTs stated that concept teaching is important in terms of showing the relationships between concepts, preventing misconceptions, and improving understanding of the subjects. Examples of PsT statements are given below:

> *"Yes, of course it is important. Because if we don't know the concepts, we cannot do anything. We cannot comprehend the relationships between them, and misconceptions arise." (PsT1)*

> *"Concept teaching is important in science teaching. If concepts are not taught correctly, misconceptions occur in students; that's why." (PsT2)*

> *"It's important, in my opinion. Because when students don't have a clear understanding of concepts, they can't grasp the subject matter effectively, unfortunately. Not understanding the subject can lead to difficulties in future courses. That's why I believe concept teaching is important." (PsT4)*

In Table 2, pre-service teachers' answers to the question "Which methods and techniques do you think can be used for concept teaching in science courses?" are given.

Table 2. *Methods and Techniques That Can Be Used for Concept Teaching in Science Courses*

Categories	Codes	Pre-service Teachers	Frequency
Conceptual change activities	Conceptual change activities used in this study	PsT2, PsT3, PsT4	3
Techniques	Brainstorming	PsT2, PsT5	2
	Six-hat thinking	PsT2, PsT4	2
	Fish bone	PsT1	1
	Question-answer	PsT1, PsT5	2
Methods	Educational games	PsT4	1
	Narrative	PsT5	1
	Discussion	PsT1	1

In Table 2, the themes of the question are methods, techniques, and conceptual change activities. It is observed that PsTs generally gave examples of teaching techniques as answers. In addition, they gave examples of conceptual change activities used in the study. Examples of PsTs' statements are given below:

> *"I can't think of many techniques for concept teaching right now, but discussion can be used; the fishbone technique can also be used; the question-answer technique can also be used." (PsT1)*

> *"Brainstorming, six-hat thinking technique, discussion—there are many other methods, but I don't see many at the moment. Such topics help students understand better." (PsT2)*

"I think there were concept maps, mind maps, and concept cartoons that we talked about in our courses, if I don't remember the name wrong." (PsT3)

"For example, if we want it to be fun, there is six-hat thinking, for example, to make what is learned more permanent by doing and experiencing. Concept cartoons can be prepared and presented to the students, and various games can be directed to the students." (PsT4)

"Now, if they are going to see it for the first time, I would prefer a straight narrative. Because it is a subject they have never known before. Then I can use different methods and techniques. Such as question-answering and brainstorming." (PsT5)

Table 3 shows the PsTs' answers to the question "How can technology support be utilized for concept teaching in science courses?".

Table 3. *Utilizing Technology Support for Concept Teaching in Science Courses*

Category	Codes	Pre-service Teachers	Frequency
Use of technology	Software and programs used in practice	PsT1, PsT2, PsT3, PsT4, and PsT5	5
	Digital games	PsT2, PsT4	2
	Web 2.0 tools	PsT5	1
	Computer support	PsT3	1

In Table 3, it is observed that PsTs mentioned the software and website used in the application, computer support, Web 2.0 tools, and digital games in their answers about how they can benefit from technology support for concept teaching in science courses. Examples of pre-service teacher statements are given below:

"For technology-supported concept teaching, for example, we prepared concept maps and mind maps related to technology. Concept cartoons and conceptual change texts helped us learn more permanently thanks to technology. We learned both practically and in a more understandable way." (PsT1)

" This semester, we took a course called Instructional Technologies. There were certain programs there. It offers students the opportunity to learn about both digital games and courses. In this way, students can solve the questions and learn the courses in a pleasant way. I think I would make use of technology in this way." (PsT2)

"I mean, technology is already necessary for the application of the methods I mentioned in the second question. You know, yes, we can create these mind maps with paper, but if we think that we want to keep a complete visual in our minds, if we want to do it very well, it is usually done with a computer. You know, when it is prepared on the computer, let me say it is more professional; at least it is more accurate. We have the chance to check and correct it. It's like you wrote it on paper, and it's done. Also, how much you can color it and how much you can make it eye-catching After all, it takes a lot of time until you draw a flower there. However, it takes 5 seconds or 10 seconds to put a flower there with a computer or anything with technology. Therefore, the use of technology is very important both in terms of time and the functioning of our courses, so that the subjects are not too boring."(PsT3)

"The concept cartoons we have already prepared can be made for the students through applications. There are some applications, such as MindManager, where we can teach concepts to students more quickly with various games through different applications. We can also quickly determine what they have learned. For example, as I said, Powtoon, we used the concept cartoon, then there were a few more, and we were asking questions to the students. (PsT4)

"There are these Web 2.0 tools. They should know most of them; I think they will be very useful. Now we cannot use them very actively because we have just learned them. I think the tools we use in the studies you have done should also be used. The next generation already uses technology tools very well." (PsT5)

In Table 4, PsTs' answers to the question "What kind of convenience did the Inspiration software used for concept mapping in the course provide you?" are given.

Table 4. *The Benefits of Inspiration Software*

Categories	Codes	Pre-service Teachers	Frequency
Professional advantage	Recommendations for use in professional life	PsT1, PsT2, PsT5	3
	Use in exams	PsT1	1
	Course teaching	PsT1	1
Different usage options	Ability to make changes to the concept map	PsT4	1
	Easy to record	PsT4	1
Ease of application	Practicality	PsT3	1
	Can be converted to Word and PowerPoint	PsT4	1

In Table 4, it is seen that three of the five PsTs stated that the Inspiration Software provided ideas for future use in their professional lives, and in the other codes, they mentioned the ease of use of the software. Examples of pre-service teacher statements are given below:

"So this application helped us see the relationships between concepts more clearly. We can use this application in many places. When we become teachers in the future, we can use it at the end of the unit or in exams, even when we are lecturing to our students. In this way, it is very useful. It provides future convenience." (PsT1)

"At first, I was hesitant because it was in English, but after the first use, it was very comfortable to use because everything was already memorized. I mean, I realized that it was no different from any Turkish application after the first use. I mean, I realized that it was comfortable. I realized that I could use these applications with my students in the future." (PsT2)

"Inspiration is actually a simple application in terms of use. Yes, now when I think that I do it with a pen and paper, yes, it may be easier than the part I had difficulty with, but as a result, it is smoother, with more beautiful lines, more symmetrical, more teacher-like. When it is given to a student, it becomes more appealing to the eye. It is necessary to try something a few times." (PsT3)

"Actually, inspiration was difficult for me at first. Then it was very easy. Because at first I was using another program before this one, that program was easier for me, but some of the features in Inspiration were not available in that program, and since Inspiration is more diverse and most of the things are free, I realized that it was more convenient for me. In others, I could not change the templates, the thickness of the arrows, the color, and so on, but in Inspiration, these can be provided. We can adjust the frames ourselves. We can make additions and subtractions on the ready template. It is very simple to save. It had many features, such as the ability to download it immediately." (PsT4)

"The use of inspiration will make it easier for us in our future professional lives, such as in lecturing." (PsT5)

Table 5 shows the PsTs' answers to the question "What difficulties did you experience while using Inspiration Software?".

Table 5. *Difficulties in Using Inspiration Software*

Category	Codes	Pre-service Teachers	Frequency
Difficulties of Inspiration Software	Being in English	PsT1, PsT2, PsT4, and PsT5	4
	Installation difficulties	PsT3, PsT5	2
	Need to fix one by one	PsT3, PsT5	2
	The habit of using other programs	PsT5	2
	Indecision due to the extensive content of the software	PsT4	1

When the answers of the PsTs are analyzed in Table 5, it is seen that they generally had problems due to the software being in English, having difficulties in installation, the width of the software content causing indecision, and the habit of using different software. It was observed that two PsTs stated that they had problems due to adaptation because they had used another software before. Examples of PsT statements are given below:

"I mean, if I used it myself, I would have had some difficulty because it was in English, but since you explained it to me and we did it simultaneously in the course, I did not have much difficulty. I did not have that much difficulty because we progressed together." (PsT1)

"I downloaded it; I couldn't install it. The program doesn't open; it shows different languages. First of all, it was very difficult to install and very labor-intensive; I couldn't install it. It's a very simple application, but when I changed one of the things in that sidebar, I thought that all of them would change. But only one of them was changing. For example, you changed the shape of one of them; you know, normally, in other applications, they all change; you know, all of them, but only one of them was changing. I had to change all of them one by one, lengthen them, and connect them; it was a bit troublesome. Then I couldn't get the screenshot thing to work. It was a bit troublesome for me." (PsT3)

"It is difficult to use it in English at first. Also, when there are many features, people are confused about which one to use." (PsT4)

In Table 6, PsTs' answers to the question "What kind of convenience did the Powtoon Web Site Used for Concept Cartoons and Conceptual Change Texts Provide You?" are given.

Table 6. *The Conveniences Provided by the Powtoon Web Site Used for Concept Cartoons and Conceptual Change Texts*

Category	Codes	Pre-service Teachers	Frequency
Conveniences provided by the Powtoon website	Ease of use and membership	PsT3, PsT5	2
	Providing a fun learning environment	PsT1	1
	Individuals prepare personalized preparations in line with their own ideas	PsT4	1
	Being a known application	PsT4	1

In Table 6, it is observed that the PsTs gave answers such as ease of use and ease of membership, allowing individuals to create according to their own wishes and providing a fun learning environment regarding the facilities provided by the Powtoon website. Examples of PsT statements are given below:

"It allows us to learn in a more fun way." (PsT1)

"Powtoon was very easy to access. That's why I prefer it to inspiration. Because I think it is easier in terms of introduction and use." (PsT3)

"I had used the Powtoon website before. Since it was an application I knew and used before, I could prepare it easily. The fact that every choice was up to us and that it depended on our imagination did not force me. It is very nice that we can adjust the time." (PsT4)

"Powtoon was a bit more colorful and easier to use than the others. It was very nice that it was in the form of GIFs; it attracts the attention of the students." (PsT5)

Table 7 shows PsTs' answers to the question "What difficulties did you experience while using the Powtoon Web Site?".

Table 7. *Difficulties Experienced While Using the Powtoon Web Site*

Categories	Codes	Pre-service Teachers	Frequency
Difficulty of access	Limited access time	PsT1, PsT3	2
	Internet-related access slowness	PsT3, PsT5	2
Difficulty of use	Positioning of cartoons	PsT3, PsT4	2
	Add text	PsT5	1

In Table 7, it is observed that the answers of PsTs about the difficulties they experienced while using the Powtoon Web site are grouped under four different codes: access slowness due to the internet, limited access time, positioning of cartoons, and adding text. Examples of pre-service teacher statements are given below:

"I had this experience with Powtoon. The app was very slow. Only the application was slow, but other than that, it was comfortable. There was a four-day trial period, and when the trial period passed, we were able to use a small part of it." (PsT2)

"I understood what was explained, but I had some difficulties when I was applying it myself because it was hard for me to bring those pictures, people, etc., whatever I talked about, whatever I did. It is like a video duration; it was a bit troublesome to adjust it, where people would come, and so on." (PsT3)

"But that was a problem; it was very labor-intensive. I had some trouble with the text-writing part. I did not fully understand where to do it." (PsT5)

In Table 8, PsTs' answers to the question "What kind of convenience did the MindManager software used for mind mapping provide you?" are given.

Table 8. *The Convenience of MindManager Software Used for Mind Mapping*

Categories	Codes	Pre-service Teachers	Frequency
Ease of implementation	Ease of use	PsT3, PsT4, PsT5	3
	Keyboard shortcuts	PsT3	1
	Ease of placement of toolbars	PsT5	1
Professional advantage	Ideas for use in professional life	PsT2	1

In Table 8, it is observed that the majority of the PsTs stated that the MindManager software is easy to use, provides ideas for use in professional life, can be done with keyboard shortcuts, and that the placement of the tools in the software provides convenience. Examples of PsT statements are given below:

"I realised that this programme is also a programme that I can definitely use in teaching concepts with my students in the future." (PsT2)

"It was really easier to use MindManager. If I remember correctly, when I pressed the enter key twice, a box would open immediately. That was very nice. After that, we could write words in the center of the arrows; that was very good." (PsT3)

"You know how we used to use arrows and stuff; we didn't need to shape them. As for the picture, whatever we typed in, the image would come out directly." (PsT5)

Table 9 shows PsTs' answers to the question "What difficulties did you experience while using MindManager software?".

Table 9. *Difficulties Experienced While Using MindManager Software*

Category	Codes	Pre-service Teachers	Frequency
Difficulties of MindManager software	Installation difficulty	PsT1, PsT3, PsT4	3
	Access shortage	PsT1, PsT4	2
	Content confusion	PsT1, PsT3	2

In Table 9, it is seen that PsTs stated that the content of MindManager software used for mind mapping is complex and that they had difficulties in the installation part. One of the PsTs stated that they did not experience any difficulties. Examples of PsT statements are given below:

"I couldn't create a mind map exactly as I wanted. I mean, it was really difficult. For example, I couldn't even open it; it froze all the time. I logged in again and again, but it still didn't work. I had a lot of difficulty. Both because it froze and because of the thickness of the arrows, for example, I had some difficulty applying it like this. That's why it wasn't exactly what I wanted." (PsT1)

"I couldn't install this one either. You know, there's a higher version or a lower version. I logged in to one of them and did it that way. But after it was installed, yes, this one was also very troublesome to install. You have to try a little bit. But after it was opened, MindManager was easy." (PsT3)

In Table 10, PsTs' answers to the question "What kind of effects do you think the use of conceptual change tools in science courses with technology support will have?" are given.

Table 10. *The Effects of Using Conceptual Change Tools Supported by Technology in Science Courses*

Categories	Codes	Pre-service Teachers	Frequency
Cognitive impact	Being effective in the permanence of knowledge	PsT2, PsT5	2
	Providing subject repetition	PsT3, PsT4	2
	Ensuring the subject's integrity	PsT1, PsT2	2
Affective impact	Curiosity-enhancing with audio and visual support	PsT2, PsT3, PsT4, and PsT5	4
	A fun course	PsT1	1

In Table 10, it is observed that PsTs stated that conceptual change tools can increase curiosity because they have audio and visual support, they can enable students to see the subject as a whole, they can be effective in the retention of knowledge, they can provide a fun course environment, and they can provide subject repetition. Examples of PsT statements are given below:

"By using these, we can make the course more fun. We can ensure that students do not get bored. We can handle the subject as a whole. In other words, in order to look at it as a whole, for example, in concept maps or mind maps, we can actually benefit by using them in this way." (PsT1)

"I think it will have a more permanent effect on students' minds because the mind map is already visual, so it will be more memorable. Apart from that, I think that the concept maps we prepare in Inspiration, for example, provide students with the opportunity to see the whole subject in a whole new way, so I think that it ensures that all the information before or after the subject is transferred correctly. Likewise, the ones I prepare in Powtoon are the most effective because we can prepare them in the form of GIFs there. Such things are more effective for students. Also, adding audio text is the same way." (PsT2)

"I think they would be more supportive in terms of reinforcing the concepts of the students, or in the first introduction to the subject, I think they would be more successful in terms of arousing curiosity, or at the end of the course, for example, they will solve a question; you know, those mind maps, concept maps, yes, they are not very detailed, but as a result, there are words; we write what comes to our minds, and then we write them in connection with each other. I think all of them are simple subject repetitions." (PsT3)

Table 11 shows PSTs' answers to the question "Would you consider using the mentioned Inspiration and MindManager software and Powtoon Web Site in your professional life in the future?".

Table 11. *The Use of Technology-Supported Applications in Professional Life*

Category	Codes	Pre-service Teachers	Frequency
Professional contribution	Useful	PsT1, PsT2, PsT5	3
	Easy	PsT3, PsT4	2
	Functional	PsT3	1
	Possibility of original preparation	PsT4,	1
	Enjoyable	PsT5	1

According to Table 11, all of the interviewed PsTs stated that they would use Inspiration and MindManager software and the Powtoon Web site in their professional lives in the future. The PsTs stated that they were useful, simple, functional, and enjoyable to use, and that they provided the opportunity to prepare original work. Examples of PsT statements are given below:

"I mean, I would actually use it; it would be very useful for us (PsT1)."

"Yes, I definitely think about it. I plan to use all of them within my means (PsT2)."

"MindManager and Powtoon Yes, inspiration is a question mark... I have to be in a very difficult situation to use it. I am skeptical about using it. They were very easy and useful applications (PsT3)."

"Of course I use it. As I said, since Inspiration and MindManager are now a little more wide-framed and wide-perspective, I use them mainly. Because it can be easy to download and transfer from one place to another. I definitely use it because it is connected to me and I can add pictures, videos, or anything else. It is free of charge (PsT4)."

In Table 12, PsTs' answers to the question "What kind of effects do you think using Inspiration and MindManager Software and Powtoon Web Site in your courses will have?" are given.

Table 12. *The Effects of Using Inspiration and MindManager Software and the Powtoon Website in Science Courses*

Categories	Codes	Pre-service Teachers	Frequency
For students	Better and more meaningful learning of the subject	PsT1, PsT2, PsT3	3
	Providing a fun course environment where students are active	PsT2, PsT4, PsT5	3
	Providing the elimination of misconceptions	PsT1, PsT3	2
	Providing subject repetition	PsT2, PsT4	2
	Demonstration of relationships between concepts	PsT1	1
For teachers	A quality teaching environment	PsT2, PsT3	2
	Time saving	PsT4	1
	For measurement and evaluation purposes	PsT1	1

In Table 12, it is seen that the answers of PsTs about the effects of using Inspiration and MindManager software and the Powtoon Web site in their courses are grouped under two sub-themes: from the student's perspective and from the teacher's perspective. It is seen that PsTs have more answers about the effects of using these tools for students. In terms of the teacher, they stated that it would provide a qualified course environment, time savings, and ease of measurement and evaluation. Examples of PsT statements are given below:

> *"I mean, if I use these, I can actually help them understand the subject better and look at the subject holistically. For example, I can use it to reveal the relationships and thoughts between concepts through concept maps and mind maps. In the application we made in Powtoon, I can use it mostly to correct students' incorrect prior knowledge. For me, I can use it as a course tool. For example, in the exam, I can use it to evaluate students by giving them concept maps with blanks (PsT1)."*

> *"I think there will be an opportunity to repeat the subject. It may give students the opportunity to understand the subject better. Since we are already in the age of technology, I think that students will comprehend such applications very well (PsT2)."*

> *"When I am going to teach something to a student, it takes me a very short time to prepare and show it with a concept map, and it would be nice for me to show the student what I am going to teach for a whole week or that day. Because maybe there are things that I will miss in the breaks (PsT4)."*

4. Conclusion and Discussion

The pre-service teachers expressed positive opinions about the technology-supported conceptual change activities and stated that they would use what they learned in their professional lives in the future. The fact that the PsTs stated that they would use these programs in the future suggests that their attitudes towards the applications were positive. In Kaya's (2010) thesis study, the fact that computer-aided conceptual change text creation positively affected the attitudes of pre-service science teachers may be related to the fact that the PsTs in the study thought of using this method in their future professional lives. Similarly, Inel et al. (2011) stated that PsTs wanted to use concept maps in their teaching lives; Kurnaz and Pektaş (2013) stated in their study that teachers' opinions about concept maps were positive.

The PsTs stated that technology support in science courses can be used with the programs used in the application, Web 2.0 tools, and digital games. In their answers after the application, it is seen that they mentioned not only the software and Web sites used in the application but also different environments and software. Accordingly, it is possible to say that PsTs are interested in technology. In their study, Ardıç, Önal, and Önal (2023) also stated that pre-service teachers had positive views about technology-supported science education practices; they said that technology-supported practices facilitated learning, increased retention, and made abstract knowledge concrete. This result is consistent with the views of the pre-service teachers in this study. In the same study, pre-service teachers stated that the lack of Turkish language support for the technological application was a negative feature. This is also consistent with the negative views of the pre-service teachers in the study.

The PsTs stated that the tools used in the application would provide better and more meaningful learning of the subject for the student and create an entertaining course; for the teacher, it would save time and create a

qualified course environment. This may lead to the conclusion that PsTs enjoy technology-supported applications. This is in line with Şahin's (2001) findings that pre-service teachers stated that concept maps provide students with the advantage of seeing concepts in an organized way, while they provide teachers with the convenience of planning and explaining complex concepts. Similarly, Holland et al. (2004) stated that students would continue to use MindManager software and that it was easy to learn and use; Yurtyapan et al. (2017) stated that using concept cartoons made them more active in the course and reduced their anxiety; in the study of İnel et al. (2009), students stated that concept cartoons should be used in science courses.

While the PsTs gave the conceptual change activities used in the research as an example to the question of which methods and techniques can be used for concept teaching, they also mentioned techniques such as fishbone and discussion. The PsTs stated that the use of technology-supported conceptual change activities in the application of science courses would provide a fun course environment, review the subject as a whole, and provide a fun course environment thanks to its features such as audio and visual support. In line with the answers of the PsTs, it can be stated that they think that there should be activities that will make the students active and mobilize their sense organs in the course environment. Similarly, Cesarina (2006) stated that concept maps provide a better understanding of the subject; Ahmed et al. (2021) and Candan et al. (2006) stated that they provide meaningful learning and remediate misconceptions; Perdana et al. (2018) stated that conceptual change texts increase conceptual understanding; Pınarbaşı and Canpolat (2002) stated that they positively affect the removal of misconceptions; İnel et al. (2011) stated that they provide a fun course environment; in Cengizhan's (2011) study, PsTs stated that concept cartoons were attractive because they were colorful and made the course interesting.

It is seen that PsTs stated that students should also be taught how to use such programs. It is realized that they take into consideration the new generation's interest in technology. It is possible to say that PsTs find it important to use effective materials that can provide more time for the course in the teaching process and thus make the course more qualified. It can be said that preparing conceptual change activities in a computer environment is less time-consuming than preparing them by hand and will be more remarkable for students. In Zeybek's (2020) study, students studying at the tenth grade level stated that concept cartoons were interesting, arousing curiosity and facilitating learning, but time-consuming. This does not coincide with the PsTs' statement that conceptual change activities save time.

The pre-service teachers stated that they would have had difficulties using the programs if they had not applied them to the course. They stated that the difficulties they experienced were due to the fact that the programs were in English. This can be attributed to the pre-service teachers' inadequate knowledge of English at a basic level. In order to solve this problem, pre-service teachers can be given basic English training for tools such as Inspiration, Mind Manager, Powtoon, etc. Since the pre-service teachers participated in the application through the distance education system, some of them had problems with the applications on their computers. In the opinions of the pre-service teachers, it is seen that they generally had difficulty accessing the internet and that the programs were slow. In order to overcome this problem, corrections can be made to the technical infrastructure, or the study can be carried out in an environment with a computer classroom. The interviewed pre-service teachers stated that they did not have much difficulty doing technology-supported conceptual change activities and that they would use them in their future professional lives. In this direction, it can be suggested that technology-supported courses should be included more during the undergraduate education of pre-service teachers studying in faculties of education. Researchers can be recommended to conduct studies in which technology-supported conceptual change activities created by pre-service teachers are evaluated with rubrics.

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