IS DIGITAL STORYTELLING FUNCTIONAL IN SOCIOSCIENTIFIC ISSUES? PRE-SERVICE SCIENCE TEACHERS' EXPERIENCES

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ABSTRACT

This study sought answers to the following question: "Is digital storytelling functional in teaching socioscientific issues?" In the framework of the study, digital stories were prepared individually by nine pre-service teachers on nine different socioscientific topics to find the answer to this question. The data of the present study, which was conducted with action research, were collected by using two different methods: pre and post-interviews and digital stories. Content analysis was used to analyze the interviews and the digital stories were analyzed by using the "digital story evaluation rubric". According to the results obtained during pre-interviews, the participants did not have digital storytelling experience before and did not have much knowledge about digital storytelling. After the implementation, the participants had predominantly positive views towards digital storytelling and that the digital storytelling could be a functional method in teaching socioscientific issues. When the participant products (digital stories) were evaluated in line with the criteria in the literature, it was concluded that the digital stories were prepared at a very satisfactory level, but the content part of the digital stories prepared by the participants lacked discussion questions about the selected socioscientific issues and the issues could not be addressed impartially.

Keywords: Digital storytelling; socioscientific issues; pre-service science teachers

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DİJİTAL ÖYKÜLER SOSYOBİLİMSEL KONULARDA İŞLEVSEL Mİ? ÖĞRETMEN ADAYLARİNİN DENEYİMLERİ

ÖZET

Bu çalışmada "dijital öykülerin sosyobilimsel konuların öğretiminde işlevsel mi?" sorusuna cevap aramaktadır. Bu cevabı bulabilmek adına dokuz öğretmen adayı tarafından dokuz farklı sosyobilimsel konuda bireysel olarak dijital öyküler hazırlanmıştır. Eylem araştırmasına göre gerçekleştirilen çalışmada veriler iki yolla toplanmıştır. Birinci veri toplama aracını ön ve son görüşmeler, ikinci veri toplama aracını dijital öyküler oluşturmaktadır Görüşmeler içerik analizine göre analiz edilirken dijital öyküler "dijital öykü değerlendirme rubriğine" göre analiz edilmiştir. Elde edilen sonuçlara göre uygulama öncesi görüşmelerde katılımcıların dijital öykü deneyimini daha önce yaşamadığı ve dijital öyküye dair yeterli düzeyde bilgi sahibi olmadığı tespit edilmiştir. Uygulama sonrasında katılımcıların dijital öyküye yönelik çoğunlukla olumlu görüşlerinin olduğu ve soyobilimsel konuların öğretiminde dijital öykünün işlevsel bir yöntem olabileceği sonucuna ulaşılmıştır. Katılımcı ürünleri (dijital öyküler) alanyazındaki kriterler doğrultusunda değerlendirildiğinde dijital öykülerin oldukça iyi düzeyde hazırlandığı görülmüştür. Ancak içerik kısmında sosyobilimsel konulara yönelik tartışma sorusu oluşturma ve konuları tarafsız bir şekilde ele almada yeterli düzeyde performans gösterilemediği tespit edilmiştir.

Anahtar Kelimeler: Dijital öykü; sosyobilimsel konular; fen bilgisi öğretmen adayları

1. INTRODUCTION

Technological advances are affecting our lives more and more, especially the children and teenagers (Sadik, 2008). All kinds of technology, from mobile phones to tablets, are always beside us, and people want to record and share their memories with these digital tools. This desire and tendency encourages educators to use digital storytelling (DS) applications in educational environments (Kocaman Karoglu, 2015). The development of technology is not limited to multimedia tools. Progress in science and technology affects many areas such as the topics on the agenda, curricula, etc. For example, a science teacher in the 1970s did not have to cover the effects of biotechnology in lectures when teaching concepts such as heat, pressure, and mass as the main science subject. However, today's teachers have to deal with many current, scientific and social issues from space pollution to pandemic vaccines. Individuals make arguments and make decisions on topics called socioscientific issues (SSI) (such as nuclear energy, biotechnology, hydroelectric power plants, etc.) that are social on one side and scientific on the other, which include dilemmas and are waiting to be resolved. Individuals need to be aware of the relevant issues and contexts for the argumentation and decision-making stages in question (Zeidler, Herman & Sadler, 2019). It can be argued that addressing the contemporary issues with modern approaches will be more effective on students. One of the new generation teaching tools in question is digital storytelling.

1.1. Digital Storytelling in Science Education

Digital storytelling is defined as a new generation learning/teaching tool that gives students or teachers a chance to express themselves using multimedia technologies (Robin, 2008). Especially during the COVID-19 epidemic, all countries employed different applications to increase the quality of distance education and teaching. Distance education may actively continue even after the pandemic. From this perspective, it can be argued that DS can be a functional teaching tool for teachers in the distance education process. Supporting this view, the results of the study conducted by Kotluk and Kocakaya (2016) demonstrated that the physics teacher candidates had positive opinions about the digital storytelling process, believed that DS could be used in distance education and digital storytelling was functional in the teaching process. The benefits of DS are not limited to distance education. The literature cites the positive impact of DS on educational settings in many areas (Seckin Kapucu & Yurtseven Avci, 2020). For example, digital storytelling was found to contribute to problem solving skills (Yuksel, 2011), critical thinking (Demirer, 2013), creativity (Wu & Yang, 2008), motivation (Hung et al., 2012; Yang & Wu, 2012), technology literacy (Chan, et al., 2017; Sadik, 2008), content knowledge about the relevant subject (Sancar Tokmak et al., 2014) and understanding the nature of science (Seckin Kapucu & Yurtseven Avci, 2020). It is believed that teachers have an important role in successfully integrating DS, which is highly effective in transferring many skills, into the teaching environment. DS, which can be used in many branches, is an increasingly popular teaching tool in science education as well. The studies combining science education and digital storytelling (Akgul, Tanriseven, 2019; Hoban, et al., 2015; Hung et al., 2012; Sancar Tokmak, et al., 2014) were designed according to the skills (achievement, creativity, motivation, attitude, collaboration, 21st century skills, etc.). Sadik's (2008) study involving Egyptian teachers and students reported that while teacher progress was observed in DS, students were also found to transfer cooperation and communication skills and knowledge thanks to DS.The study carried out by Titus (2012) concluded that American students were able to make sense of science concepts and make explanations to their classmates thanks to the digital stories they prepared. The project-based digital storytelling study conducted by Hung et al. (2012) in Taiwan found that students' motivation, problem-solving skills and academic achievement increased. The project-type research conducted in Romania by Craciun, Craciun, and Bunoiu (2016) aimed to demonstrate the usability of DS in science education by designing a project in which pre-service teachers, academicians and secondary school students could be involved in the process. At the end of the process, improvements were observed in the 21st century skills of the pre-service teachers, while the secondary school students reported finding the DS practices exploratory, instructive and entertaining. The study conducted by Sancar Tokmak et al. (2014) investigated the development of pre-service science teachers' technological pedagogical content knowledge in the DS creation process.Instead of focusing on units, many studies in the literature focused on the skills (motivation, success, 21st century skills, etc.) which were desired to be developed.The research in the current study was designed with a subject-oriented approach and set

out to have pre-service teachers prepare a digital story in the context of SSI. It is believed that the philosophy of DS and the nature of SSI are complementary. For example, the important components of DS such as point of view, dramatic question, etc. are also important in SSI. DS can be defined as the setting in which students have the opportunity to express themselves, SSI can be described as the situations and contexts in which students have the opportunity to express their worldviews and decisions. With digital storytelling, students can discuss the topics presented in the story and an interactive learning environment can be created (Robin, 2008). Another connection between SSI and digital stories is discussing the content in a controversial environment, accompanied by dramatic questions and contexts. As a matter of fact, scenarios involving dilemmas are frequently used in teaching SSI in the classroom environment and the results are included in the literature (Lin & Hung, 2016; Shea, et al., 2015). In this context, it is believed that addressing SSI and DS together will yield striking results.

1.2. Socioscientific Issues in Science Education

Due to the effect of the reflection of scientific developments on daily life, media and therefore on curricula, SSI in science education has become one of the subject areas that have been studied significantly, especially in the last 15-20 years. So much so that most countries aim to address SSI in their curricula in parallel with this trend. For example, in the United States, the National Research Council (NRC) (2012) defines the primary goals of science education as involving students in discussions on science-related issues, becoming conscious consumers of scientific information in their daily lives, and learning science throughout their lives. Similarly, SSI has become significant in the science curriculum in Turkey since 2013, when the program changed. The curriculum revision in 2018 enabled the inclusion of SSI in the curriculum even more (MoNE, 2018). It is believed that the type and number of SSI will increase over time as scientific developments increase and it will be addressed more in teaching programs. However, differences of opinion on SSI will continue to be effective in the future because, although SSI is very popular in both curriculum and literature studies, it does not have a definite answers, even in specific situations due to controversial content. Therefore, discussions about SSI will continue (Sadler, et al., 2017). These differences of opinion enable the use of different concepts such as argumentation, decision making, reasoning, etc. In this context, SSI studies in the literature are generally associated with argumentation skills (Evren Yapicioglu & Kaptan, 2018; Lin, et al., 2014), decision making skills (Es & Ozturk, 2021; Jho, 2015) and informal reasoning skills (Sicimoglu, 2020). In other words, most of the studies in the literature focus on how SSI can be integrated into science courses and how the content developed in this context affects students' knowledge, skills and attitudes. Limited number of studies in literature addressed SSI as a goal, not as a tool and associated SSI with different applications. Although SSI is addressed both as a tool and an goal in classroom settings, the most important factor in transfering all the relevant skills to students stands out as teacher proficiency. The most important component in SSI teaching is believed to be the understanding and competencies of teachers who will transfer SSI into their classrooms (Han Tosunoglu & Irez, 2017). Levinson and Turner

(2001) state that in SSI teaching, teachers cannot design long-term teaching environments and have difficulty in attracting attention and establishing relationships. Han Tosunoglu and Irez (2017) reeached the same result and concluded that nearly half of the teachers cannot use appropriate and up-to-date techniques when addressing SSI in classroom settings. In addition, Presley et al. (2013) emphasize that interesting contexts should be created by using media/technology in the teaching of SSI in order for teachers to provide quality teaching. The literature includes studies that start with a video demonstration (Bosser & Lindahl, 2017) or by reading a short story (Tomas & Ritchie, 2014) to make SSI contexts interesting. The present research utilized digital stories created by adding videos, stories and various other components (music, content, effects, imagination, etc.). Whether digital or traditional, there are a few things to consider in stories created in the context of SSI. First, the scenarios should have interesting and valid content. Second; opposing ideas should not prevail over each other and should not create prejudices in scenarios, they should be fair and objective (Tsai, 2018). Third, preliminary information should be provided to students (Dawson & Carson, 2017). Another dimension of this research addressed the content and quality of the stories prepared within the scope of SSI.

1.3. The Relationship between Socioscientific Issues and Digital Storytelling

The impact of advances in science and technology has brought the possibility of including both SSI and DS in the curriculum. Despite significant progress in both SSI and DS fields in recent years, it is possible to say that teachers still do not feel ready for both subjects (Han Tosunoglu & Irez, 2017). Carson and Davson (2016) emphasize teacher competences to provide effective teaching about SSI and argue that teachers should be competent in identifying the appropriate techniques to create the ideal teaching environment. These techniques vary in the literature; for example, short story (Tomas & Ritchie, 2014), dilemma cards (Shea, et al., 2015), case study (Knight & McNeill, 2015), scenarios (Lin & Hung, 2016) and studies using video demonstrations (Bosser & Lindahl, 2017) can be used in the classroom implementation of SSI. The relevant theme is presented to the student in a context by using these techniques. This study made use of DS in SSI because today's students like to spend time with technology (Junco, 2015). When the students create their own stories and prepare videos, learning can be realized with dedication and involvement. In this context, it is thought that the research will contribute to the relevant literature by focusing on how to attract today's students to the lesson, by emphazising science, technology and creativity together. Multiple perspectives are important in creating both DS and SSI. The relevant context can be presented more interestingly with DS as confirmed by the studies of Park, Ko and Lee (2017) which concluded that students can develop multiple perspectives, increase their socio-ethical awareness, and improve empathy and negotiation skills with the use of DS in SSI. The results of their research also showed that developed digital stories made the teaching environment fun and interesting. Similarly, in the project by Smith, Shen, and Jiang (2019), students prepared science fiction films based on SSI and using digital platforms (multimodal science fiction). The study concluded

the student work provided added value in many aspects such as contributing to students' problem solving, cooperation, argument presentation and creativity.

1.4. Significance of the Research

Literature review shows that there are quite a lot of studies in both DS and SSI fields. However, the number of studies that address the keywords of this study, DS and SSI together, is quite limited (Ozturk & Bozkurt Altan, 2018; Park, et al., 2017). It is believed that DS helps demonstrate student potential in a concrete manner and therefore digital stories can be functional learning tools.Teachers play a key role in transferring both the themes included in the curriculum and contemporary teaching methods to the classroom environment. Since pre-service teachers will soon be employed in teaching environments, it is crucial that they have relevant experience in education faculties and be informed of current techniques. From this perspective, this study aimed to provide pre-service teachers with experience regarding a contemporary practice before starting their teaching careers and to observe the potentials of young people.In this context, it is believed that the current study will contribute to the literature. The study sought answers to the following question: "Is digital storytelling functional in teaching socioscientific issues?" with the sub-questions listed below.

1- What are pre-service teachers' views and expectations regarding the digital story process before the implementation (before preparing digital stories)?

2- What are pre-service teachers' views and experiences regarding the digital story process after the implementation (after preparing digital stories)?

3- What is the quality of the prepared digital stories regarding the criteria listed in the literature?

4- What is the content and quality of digital stories in the socioscientific context?

2. METHOD

Action research, one of the qualitative research approaches was used in the research. Action research aims to find a solution to an existing problem and allows the researcher to be a practitioner throughout the process (Yildirim & Simsek, 2013). In other words, in action research, it is possible for the teacher to personally participate in the research process and turn the school into a research field. In addition, a new practice is presented and analyzed in action research along with evaluations about the process (Clark et al., 2020). In this study, the author is involved in the process both as a researcher and as a lecturer in the course "Special Topics in Science". This study was designed so that pre-service teachers could both experience a digital application and present their arguments with higher quality during the DS process. Based on these, the study was conducted with action research design.

2.1. Participants

Study participants were 4th year students in the Department of Science Education at a state university in Turkey. The researcher, with expertise in SSI and argumentation in science education,

explained the research process to 21 pre-service teachers enrolled in the elective course "Special Topics in Science". Nine pre-service teachers stated that they could be involved in the research process which was carried out on a voluntary basis. The participants had not taken any other courses that directly dealt with argumentation and socioscientific issues before taking the relevant course. However, they had attended several courses that may be partially related to argumentation and SSI in the first three years of their undergraduate education. For example, they learned about the argumentation method in courses such as "Science Teaching I" and "Science Teaching II" in the 2nd year of undergraduate education. Similarly, socioscientific issues were included in courses such as "Nature of Science", "Evolution", "Biotechnology" and "Environmental education". Participantswere included in this research in the last semester of their undergraduate education which lasted 8 semesters in total.

2.2. Research Process

The research process covered 15 weeks. Figure 1 presents the research process.
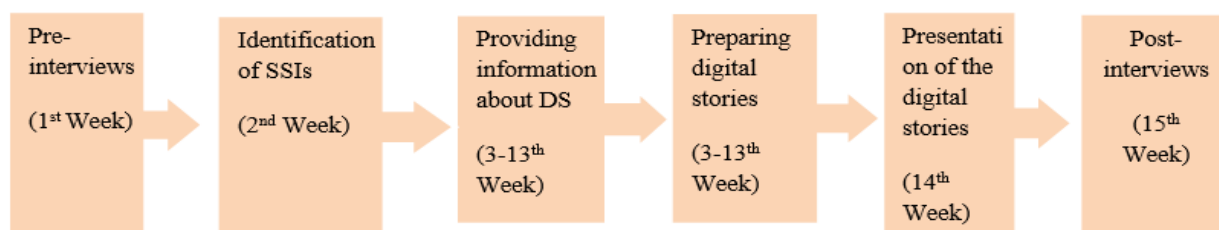

Figure 1. Research Process

Individual interviews were conducted with the nine participants in the first week of the research process. The interviews aimed to pinpoint prior knowledge and experiences of the participants about digital storytelling. The socioscientific issues on which the participants would prepare a digital story were listed by the researcher and presented to the participants in the second week of the study. Table 1 lists the topics which were selected by the participants as well as the topics not preferred.

Table 1. Socioscientific Issues Presented to Participants for Digital Storytelling

Participant	Socioscientific issues selected by the participants	Socioscientific issues not selected by the participants
P1	Acid rains	Space pollution
P2	Organ donation	Illegal use of electricity
P3	Genetically modified organisms	Nuclear power plants
P4	Waste control and recycling	Pandemic vaccines
P5	Biotechnology/cloning	Drug use
P6	Test animals	Medicine and alternative medicine
P7	Global climate change	Euthanasia
P8	Hydroelectric power plants	Base stations
P9	Biodiversity (Endangered creatures)	Local socioscientific issues Other

Nine topics were chosen by the participants from the list, which included about twenty SSIs. In addition to the SSIs in the literature, a local socioscientific issue was presented to the participants as well as the option of "other". In other words, the participants could freely choose the subjects for their

digital stories. According to Table 1, the participants generally preferred the SSIs with environmental content.

The researcher provided guidance to the participants about DS during the 3rd and 13th weeks of the study. Each participant was interviewed individually before or after the lesson to determine which stage they were in, whether they were experiencing difficulties, etc. (Mentoring service). The process included preparing the digital stories.

In the 14th week of the research process, the participants presented their digital stories to the other participants in the study group and the researcher. This stage included self-assessment and peer-assessment and allowed collecting information about aspects beyond the process. The evaluations in this stage were not included in the scores since they were not planned directly to collect assessment data. At the end of the research process, in the 15th week, individual interviews were conducted so that the participants could evaluate the process and the implementation process was completed.

2.3. Data Collection Tools
2.3.1. Interviews

The first data collection tool used in this research was the interviews conducted before and after the DS implementation. The interviews aimed to reveal the participants' experiences regarding the digital storytelling process. They were used to find the answers to the first sub-problem. Pre-interviews lasted about 15 minutes (five questions), while post-interviews took about 30 minutes (eight questions). the pre-interviews generally aimed to determine participants' prior knowledge and experiences about SSI and DS. The post-interviews conducted at the end of the implementation aimed to reveal participants' experiences about the digital story preparation process, which lasted about 12 weeks. The interviews set out to elicit information about participants' affective experiences (having fun, experiencing difficulty, enjoyment, etc.) and cognitive experiences (the relevance of digital stories on socioscientific issues, content, etc.) in the process.

2.3.2. Digital Stories (Participant Products)

The digital stories prepared by the participants were used as the second data collection tool in this study. Participant products both laid the groundwork for pre-service teachers to experience the process and gave the researcher an idea about whether these products fit the criteria of digital stories as presented in the literature. In addition, these stories were thought to be a functional data collection tool which would reveal participants' quality of argumentation.

2.3.3. Data Analysis

Interview data were analyzed via content analysis method. The data obtained from the pre- and post-interviews were transcribed and codes and themes were created. In this process, matrices were created by the researcher to see the findings in a detailed manner thanks to the small number of

participants. The matrices and other visuals not only provide insightful information but also allow presentation of the data in a more concrete manner (Miles & Huberman, 1994). Table 2 presents an example of content analysis obtained during the analysis phase of the interviews.

Table 2. Example of Content Analysis

Theme	Code	Sub-code	Participant View
		Would prefer	*I would definitely prefer using the digital story in my teaching life. I think it is a very instructive, modern and extraordinary method. (P7)*
	Preparing it individually	Would partially prefer	*I would rarely choose to use it. Digital stories on difficult topics can be functional. (P5).*
	Getting it prepared by the students	Would not prefer	*I would not prefer using the digital story unless I have to. There are many animations and videos on the internet. It's easier to use them. (P6)*
		Negative	*When I become a teacher, I will not give students a digital story project. It's not interesting or exciting. (P9)*
Digital story in professional life		Partially	*I can assign digital story assignments to my students according to the grade level and physical facilities (eg having a PC etc.) (P4).*
		Positive	*I think digital story is a practice that can contribute more to students than classical homework or practices. (P3).*
		Have difficulty	*I struggled with each of the following stages: finding suitable visuals, the design, the voiceover, etc. (P2)*
Digital story in the implementation process		Have partial difficulty	*When I first used the program, I had some difficulties due to my inexperience. But the voiceover part was quite fun (P1).*
		Do not have difficulty	*I had no difficulty. I had a lot of fun. I played some characters by changing my voice. I really enjoyed it (P8).*

The researcher carried out content analysis with an inductive approach within a hierarchy in the form of subcode, code, and theme.

Descriptive analysis method was used to evaluate the digital stories. Digital story evaluation rubrics in the literature were examined and the rubric developed by Sadik (2008) for teachers was selected to be used in this study since it is more detailed compared to many other rubrics in the literature.

The analysis in the first stage centered on the question whether the digital stories prepared by the participants were "real digital stories" based on the criteria listed in the literature. The rubric developed by Sadik (2008) was used to answer the first question. The analysis on the second stage focused on the successful integration of the digital stories with socioscientific issues based on the criteria presented in the studies of Atabey, Topçu, and Çiftçi (2018). SSI scenarios or stories include criteria

such as giving preliminary information about the relevant topic, presenting positive and negative ideas and establishing a discussion question.

The data were recorded and examined several times to be objective and transparent during data analysis. However, the method commonly used in qualitative research to ensure validity and reliability is to involve more than one person in the analysis process. Hence, support was received during the data analysis phase from another researcher (independent rater), an expert in science education and qualitative analysis. According to Miles and Huberman's (1994) consensus/disagreement formula, a consensus of 92% was achieved between the researcher and the independent rater, who examined half of the transcripts. Participant confirmation was also used to increase the validity, reliability and verifiability, to eliminate the researcher's subjective assumptions or misunderstanding of the data. Credibility and transferability are the two key concepts in qualitative research that are as important as validity and reliability. The research process was explained in detail to the reader and examples from the natural data of pre-service teachers were presented as quotations in the findings section to ensure credibility and transferability in the current research. Based on the practices used during the analysis process, the study is believed to confirm with validity, reliability, credibility and transferability criteria.

2.4. Ethical Procedures

Procedural ethical rules were followed in this research and ethical permission was obtained from Mersin University Social and Human Sciences Ethics Committee (nr.26/08/2021-36). Later, participants were included in the research process based on principle of voluntary participation. Attention was paid to privacy and confidentiality and the names of the participants were not used within the framework of research ethics. Instaed, codes were used for the participants such as P1, P2.

3. RESULTS

The research findings include the results about the DS experiences and the results about the quality of the digital stories regarding the use of SSI. Figure 2 presents participants' views and experiences before the implementation while Figure 3 and Figure 4 present participants' views after the implementation.
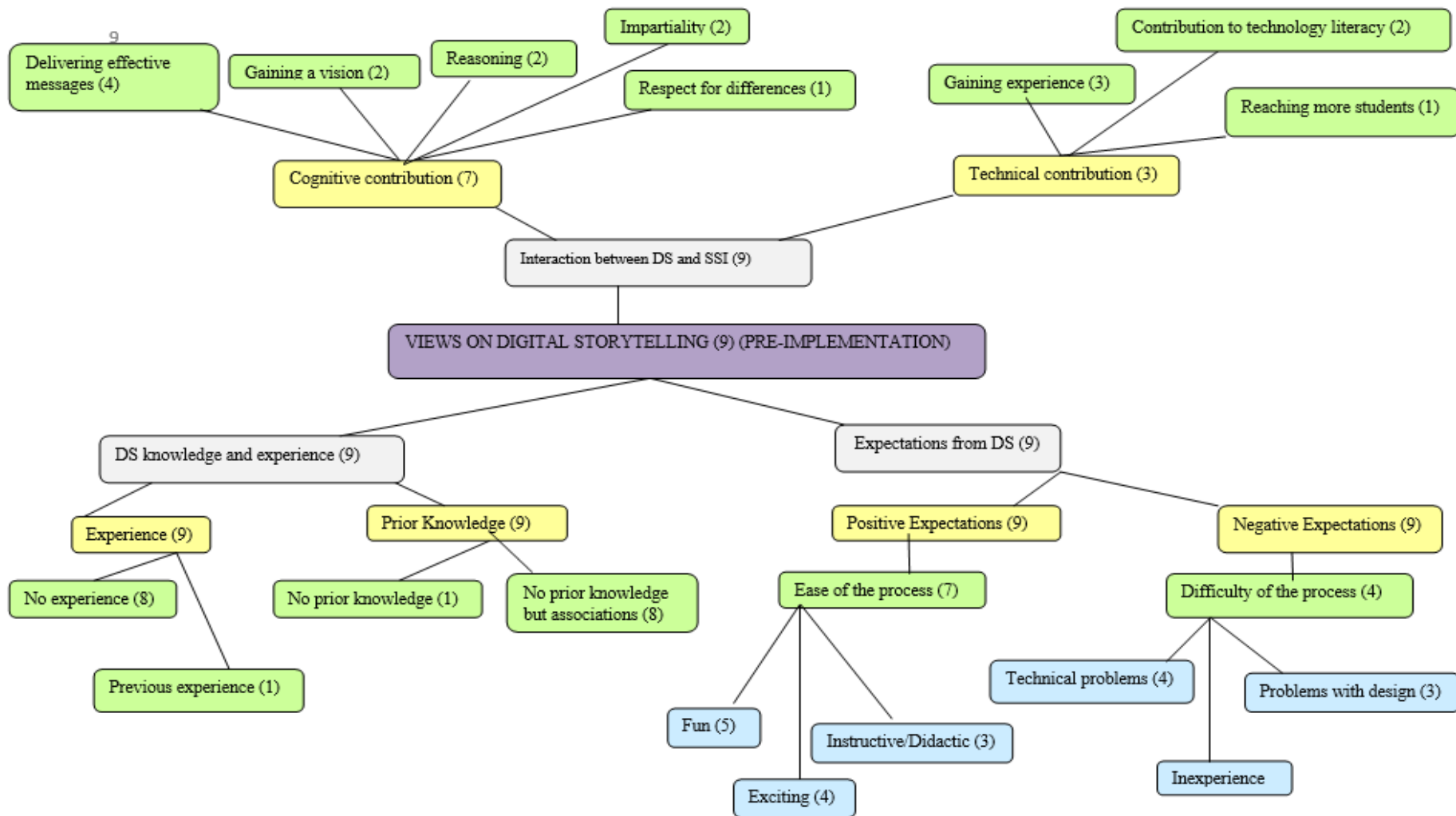
Figure 2. Participants' views and experiences before the implementation

The participant responses during the interviews before the digital story preparation process were gathered in three categories: experiences, expectations, and interaction of digital story and socioscientific issues.

It was found that the majority of the participants had no previous DS experience. Although the participants could not clearly define DS, they tried to make predictions via associations. For example, they made definitions such as "edited audio story" and "dubbing photos". A participant statement is provided below as an example.

"As far as I understand from the word digital, it is the type of telling the story in a modern way." (P3)

When asked about their expectations regarding the digital story preparation process, participants cited positive and negative points. Seven participants hoped that the process would be easy, and some of them stated that it would be fun, while others stated that it would be instructive. Two participants expressed positive opinions about the process and stated that it was exciting to learn new things. When the findings in the expectation category are evaluated in general, it can be argued that the participants had positive predictions and expectations for the digital story preparation process.

"I don't know the digital storytelling process exactly, but I think it will be a fun process. Although it is a bit of a challenge, it must be exciting to prepare a rich teaching material with visual and auditory elements." (P8)

Some participants had negative predictions about the digital story preparation process. Four participants predicted that this process would be challenging and one of them stated that it would be difficult in technical terms (for example, dubbing, adjusting the pacing, etc.). Most of the participants stated that they would prepare a digital story for the first time and therefore they would be inexperienced. In addition, some participants voiced concerns about designing the digital story, preparing the content, etc. There are also participants who think that they will have difficulties in such stages. Some participant statements are provided below.

"All the stages such as finding the images, the transitions, dubbing, are difficult stages. Even if they are all taken care of, our minds will be very tired making the whole to be coherent and harmonious." (P5)

"Since socioscientific issues are open-ended and should be explained in an unbiased figure, I think I will have a hard time. I need a very good editing and design process." (P2)

The results obtained from the interviews with the participants after the implementation are presented in Figure 3 and Figure 4. Figure 3 presents the general views on the educational aspect of DS.
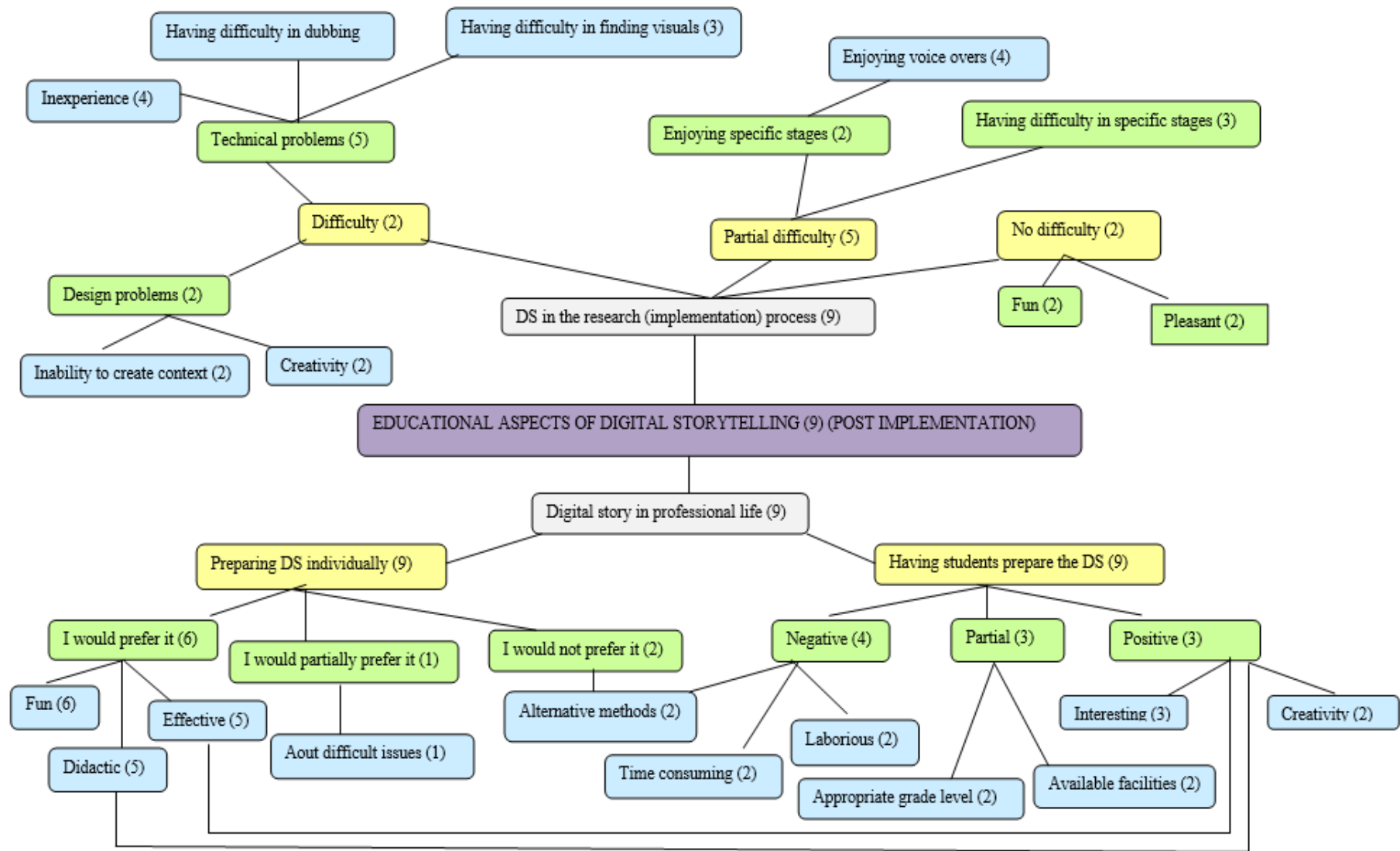
Figure 3. The General Views on the Educational Aspect of DS

In Figure 3, the views of the participants are presented from specific to general. The upper part of the figure presents the participants' short-term DS experiences in the implementation process. Based on these experiences, the long-term views of the participants regarding their professional lives after graduating from the education faculty are presented at the bottom of the figure. Whether the participants will include DS in teaching environments individually (themselves as teachers) in the future or will include DS by having their students prepare digital stories is presented here as well.

Most of the participants were observed to experience some difficulties in their DS experiences during the research process. Participants reported having difficulties stated that they had difficulties at specific stages (for example, dubbing), but they enjoyed the overall process. However, the opposite was also true. Some participants expressed that they did not enjoy the general process and did not find it difficult at any specific stage but they enjoyed the end result. While analyzing the findings, the dubbing stage became a focal point. In the interviews, eight participants mentioned that point and stated that this stage was either very difficult or very enjoyable. A participant's view is provided below:

"I didn't have any problems with the images, but I had a hard time reflecting the voices of the characters while recording the sound. There were a lot of problems at this stage." (P7)

Participants who declared that they had difficulties mostly emphasized technical problems. While there were participants who had problems in finding images or in dubbing, there were also participants who had problems during the design phase. The participants who had difficulty in creating the context and who reported experiencing difficulties in creativity were included in the category of design problems. The participants who reported having a lot of fun and experiencing no difficulties during the process stated that their experience of DS was very pleasant for them.

"I was never involved in digital storytelling before and yet I was not challenged. It was very enjoyable. Learning new things is very valuable and pleasant for me." (P3)

The researcher asked the participants whether they would use digital storytelling in their future professional lifes. The responses were categorized in two categories as DS by the teacher and the DS by the students. Most of the participants stated that they would prefer using DS in their professional lives because it is effective, entertaining and instructive. Example of participant statements is presented below.

"In my professional life, I prefer both to prepare a digital story as a teacher and to have my students prepare it. I would even offer to dub the story together if my students agree. It would be a good collaboration. Their learning would be reinforced, their creativity will develop." (P8)

Reporting partial preference for DS, a participant said that it could be included in the classroom depending on the appropriateness of the subject to DS. Two participants declared that DS did not have a significant effect and thought that it would be appropriate to include much more effective alternative teaching methods (drama, effective videos on the internet, web 2.0 tools, etc.) instead of spending time and effort on DS. Example of participant statements is presented below.

"In my opinion, DS is not effective. As a teacher, I would not prepare digital stories myself, nor would I have my students prepare them. There are much more effective videos on the Internet." (P9).

The participants, who did not take kindly to the idea of having students prepare a digital story, emphasized that this method is time-consuming and laborious. Some participants stated that they would prefer alternative methods in professional life for these reasons. The participants who stated that they would use DS at some grade levels (for example, in 7th and 8th grades) or under some conditions (if students have a computer) were included in the partial category. The participant's opinion supporting this view is given below.

"I would not prefer to have my students prepare digital stories. They can have difficulty. It may not be functional in younger age groups, or it may be a challenging process for students with no technical means." (P1)

It can be argued that the participants regarded teachers' digital story preparations positively while considered student's digital story preparation to be partially positive. In other words, it was believed that DS would be more functional when teachers were involved in preparation teacher's but difficulties may be experienced when students took the lead.

Figure 3 addresses only the findings regarding the DS process. Figure 4 presents the integration of DS and SSI. To put it more clearly, Figure 4 presents participants' views on the use of digital stories while discussing socioscientific issues.
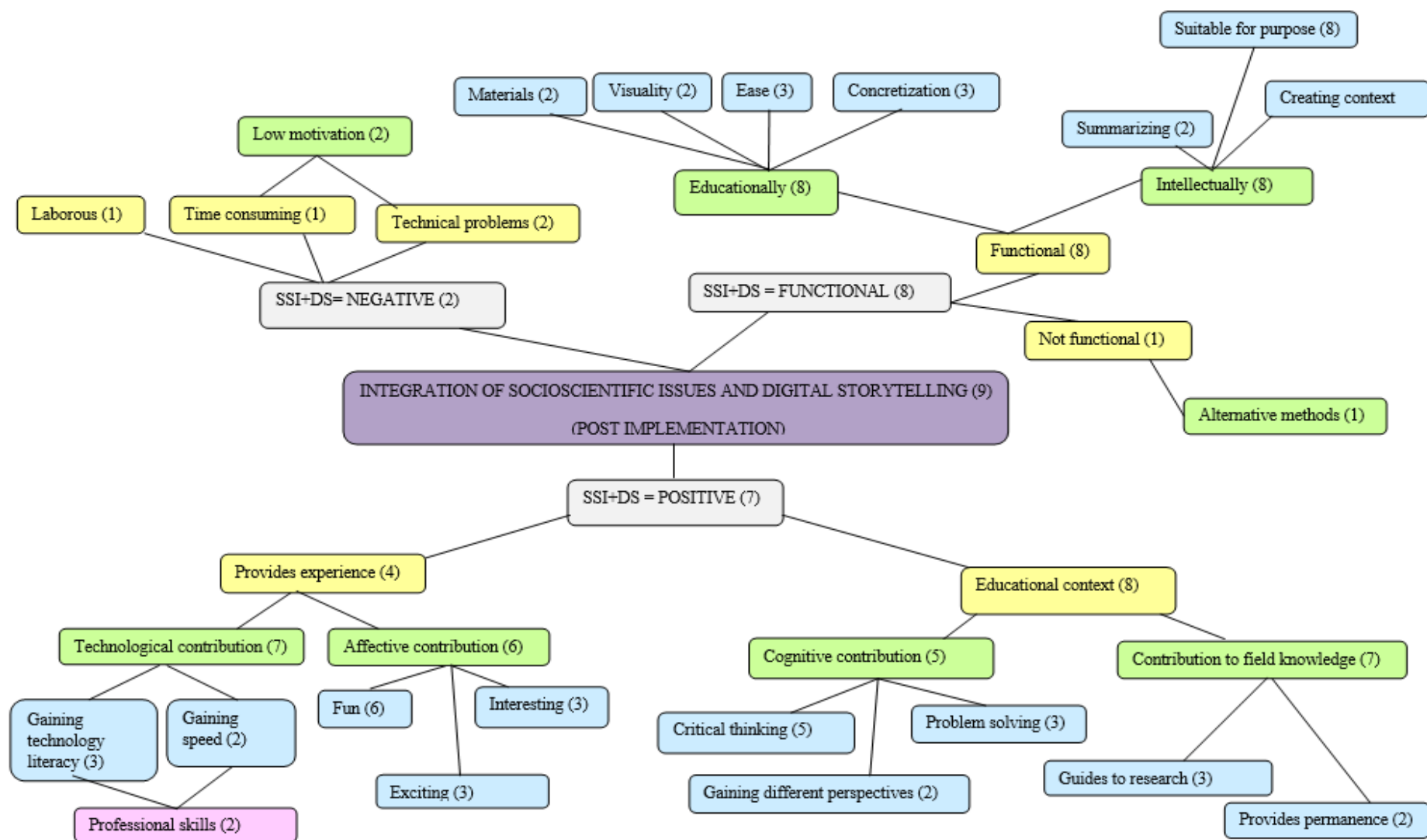
Figure 4. Integration of socioscientific issues and digitalstorytelling

Figure 4 shows that the majority of the participants had a generally positive opinion on the use of DS in SSI. Only two participants expressed a negative opinion about this process. These two participants emphasized that the digital story preparation process was a laborious and time-consuming method. In addition, possible technical problems may cause low motivation for DS. P5 mentioned some the shortcomings in regards to this issue.

"I had technical problems during this process. I was bored and fed up. I tried to increase my motivation by telling myself that this story could be useful for me in my professional life." (P5)

The participants, who were positive about the use of DS in socioscientific issues, evaluated the process both in terms of education and experience. The participants, who stated that preparing digital stories contributed to them both technologically and affectively, reported that their technology literacy increased and they gained speed in the technical sense in this process. Therefore, some participants argued that they would be more professional in the digital sense. The participants who stated that DS is a fun, interesting and exciting teaching material, stated that it would contribute to the teaching process in an affective sense. Participants stated that digital stories would enliven SSI teaching and allow striking points to be emphasized. P6, who was of this opinion, used the following statements in this part of the interview.

"Storytelling of a controversial issue, which is usually addressed verbally, by supporting it with visuals, and moreover, showing striking points in a 5-6 minute story will attract students' attention." (P6)

The participants, who regarded DS in an educational context, believed that DS will contribute to both the teacher and the students. Participants stated that thanks to DS, they could gain the ability to think critically, solve problems and look at issues from different perspectives. Participants who believed that there would be positive effects in terms of content knowledge stated that DS encouraged research because it was required in the preparation stage of the DS.The statement of a participant on this subject is presented below.

"I had the opportunity to learn about the socioscientific topic I chose via both research and watching videos. Considering that digital stories are a multimedia learning tool, we can understand that they will make learning permanent." (P7)

Almost all participants agreed on the functionality of DS in SSI teaching. While eight participants expressed positive opinions at this point, one participant stated that digital stories were not functional and a meaningless method when considering the time and effort spent on preparation. The participant, who stated that he was more interested in alternative teaching methods in SSI teaching for this reason made the following statement.

"If there is a scenario and dialogue to teach the subject, I can make it into a drama activity with my volunteer students. I think it will be much more fun and effective. I don't think DS is interesting." (P9)

The vast majority of the participants found DS to be educational and intellectually functional both as an activity and a teaching material in the educational sense. However, some participants stated that socioscientific issues had a morbid and solution-oriented side due to their nature. In this context, it was stated that SSI, already complex for students, could be difficult and abstract in DS. From this point of

view, a participant, who stated that DS would be a method to make the subject easier and concrete, shared his/her views with the following sentences.

"It is very difficult to describe SSI contexts by simplifying them at students' grade level. I think DS will make this difficult process easier." (P2)

From an intellectual point of view, the participants pointed out that DS was functional in terms of summarizing and creating context, and that would be an effective method to serve the purpose. It was stated in the interviews that the teaching part could be quite long since SSI was open to discussion. However, it was thought that DS could be a solution for this disadvantageous situation and would contribute to summarizing the issue. The participants believed that DS would be an appropriate method in teaching SSI.

"At the core of socioscientific issues is a real or imagined scenario or context. Similarly, there is a scenario or context at the core of digital stories. For this reason, I think that teaching the subject through context is suitable for both digital story and socioscientific issues." (P8)

3.1. Results Obtained from Digital Stories

The digital stories, the second data collection tool of the study, were analyzed based on their content according to the criteria in the literature and presented in tables. Table 3 present these results with their sub-dimensions.

Table 3. Rating of Participants' Stories (N=9)

Criteria	Poor (1)	Average (2)	Good (3)	Very Good (4)	Excellent (5)	Mean
Point of view			✓			3.77
Content				✓		4.00
Resources				✓		4.11
Curriculum alignment				✓		4.11
Camera and images			✓			3.77
Title and credits		✓				2.88
Sound				✓		4.22
Language			✓			3.77
Pacing and narrative				✓		4.33
Transitions and effect				✓		4.11
Final score						3.90

In Table 3, participant products were given values between 1-5. The participants performed very well in in pacing and dubbing while preparing their digital stories. In addition, the participants were able to present successful examples in determining the content, using resources, adapting the subject to the curriculum content (level) and providing transitions. The participants who were partially successful in choosing language, camera and images also performed at an acceptably moderate level (good) in the dimension of representing/not representing SSI perspective. At this point, considering that the relevant SSI should be handled in an impartial manner, it can be argued that the participants partially complied with this principle.The dimension in which the participants have the lowest average is the part of naming the digital story. Obtaining the lowest average participants in this sub-dimension was one of the most

striking results of the study. While Table 3 presents all participant findings in general, Table 4 provides separate participant performances.

Table 4. Individual Evaluation of Participant Stories

Criteria	P1	P2	P3	P4	P5	P6	P7	P8	P9
Point of view	4	5	2	4	4	2	5	5	3
Content	3	5	3	5	5	2	5	5	3
Resources	3	4	3	5	5	4	4	5	4
Curriculum alignment	4	4	4	3	5	3	5	5	4
Camera and images	4	4	4	4	3	4	3	4	4
Title and credits	5	3	2	3	3	2	3	2	3
Sound	4	5	5	4	3	4	5	4	4
Language	4	4	4	4	3	4	5	3	3
Pacing and narrative	5	4	5	5	4	3	5	4	4
Transitions and effect	5	4	4	5	4	2	5	4	4
Final score	41	42	36	42	39	30	45	42	36

Numerical examination of the results in Table 4 shows that the digital stories were evaluated over a score of 50 and the participant scores were between 30 and 45. The majority of the participants were able to score above 40. The SSI selected by the participant with the lowest score was the test animals and the SSI selected by the participant with the highest score was global climate change.

3.2. Analyzing Digital Stories in a Socioscientific Context

According to the criteria in the literature, examination of the DS prepared by the participants in the context of SSI requires that the scenario and context should contain basic information and should examine these multi-faceted issues from both sides. There should be a balance when considering the positive and negative points and no perspective should be imposed in an overt or latent manner. When the said criteria were tabulated and the participant products were analyzed within the framework of these principles, the results in Table 5 emerged. A 5-point rating scale was used in Table 5.

Table 5. Analyzing Digital Stories in a Socioscientific Context (N=9)

Criteria	P1	P2	P3	P4	P5	P6	P7	P8	P9	Mean
Providing preliminary information	4	5	2	5	5	3	5	5	5	4.33
Providing positive information/ideas	3	5	1	4	5	2	2	5	1	3.11
Providing negative information/ideas	4	2	4	4	4	5	3	4	4	3.77
Providing the discussion question	1	5	3	2	1	1	1	1	3	2.00

Based on Table 5, it was concluded that the participants were able to successfully incorporate theoretical information about the relevant SSI into the scenario of their digital stories. Considering the above principles, it is desirable to present the positive and negative aspects of SSI to the student in a balanced (neutral) manner. In this context, based on the individual scores of participants, it can be argued that some participants were not able to reflect the positive/negative aspects of the relevant SSI in a

balanced manner. For example, P3 scored 1 point for positive aspects and 4 points for negative aspects. Observing this case in half of the participants (P2, P6, P7, P9) was negative finding. In summary, it can be concluded that the participants could not address the relevant SSI in their digital stories in an unbiased manner and acted partially subjectively while reflecting the positive or negative points in their stories. When the positive and negative points were evaluated separately, it can be argued that the participants had an acceptable and moderate (good) level of success.

4. DISCUSSION AND CONCLUSION

First and foremost, this study explored pre-service teachers' views and experiences on digital story preparation. Then, the study addressed whether the prepared digital stories complied with the criteria and whether they were succesfully integrated with SSI. Hence, the research had a four sub-research questions.

The answer to the first research question (the participants' views and expectations before implementation) was collected through interviews. It was found that the majority of the participants had their first experience and in general, they predicted that this process would be enjoyable. Participants believed that the DS process in the context of SSI would contribute to technology literacy. As a matter of fact, this expectation was met based on participant responses in the post-interviews. As in this study, many studies conducted with different age groups in the literature concluded that the participants regarded their DS experience positively (Craciun et al., 2016). For example, the first stage of the research conducted by Ozturk and Bozkurt Altan (2018) included the preparation of a DS about SSI by pre-service teachers and presentation of the prepared stories to secondary school students. At the end of the process, it was determined that the participants had fun during both the preparation and presentation phase of the DS.Although the process experienced by the participants was generally considered to be positive, some difficulties were encountered. Some participants reported technical difficulties and difficulties during the design phases. Sadik (2008) reported that teachers considered technical difficulties as the biggest problem when using DS in their lessons. The study conducted by Sancar Tokmak et al. (2014) concluded that pre-service teachers had a lot of difficulty in the process of creating stories, and that the participants had difficulties in creative thinking and creating visual materials. The study conducted by Uslupehlivan et al. (2017) examined pre-service teachers' experiences of creating digital stories and grouped the difficulties experienced by the pre-service teachers under three headings as technical difficulties, difficulties encountered in the process of creating a story, and time constraints. These comprehensive results were parallel to both the result of the present research and the results of the two studies mentioned above.

In these research interviews, most of the participants stated that they would include digital storytelling in their professional lives in the future, but as a teacher, they would prepare the digital stories themselves. Dogan and Robin (2008) stated that the digital stories could be prepared by both the teacher and the student, but in general, the tendency was getting the students to create stories. Participants in

this study showed a contrary view to the trend in the literature and thought that it would be more appropriate for teachers to prepare the digital stories. Some participants argued that secondary school students should not prepare digital stories because they might have difficulties. This result may be related to the problems experienced by the pre-service teachers in the process. The fact that the participants had their first DS experience in this study and were newcomers to the process may have complicated the process. In addition, preparing their first digital stories in the context of SSI may have challenged the participants even more because they had to consider both the DS criteria and the criteria for preparing scenarios suitable for the SSI context. For example, pacing is a criterion in preparing a digital story (Sadik, 2008). According to Tsai (2018), different ideas in SSI scenarios should be given in a manner that will not overpower each other. A successful digital story in SSI is expected to meet both of the above conditions. In this context, participants need to be competent in two separate issues.

In the context of the third research question, the digital stories prepared by the participants were evaluated in line with the criteria in the literature and the participant products were found to be successful in general. While the participants performed more successfully in the sub-components of the stories such as pacing, sound, transitions, and effects, they showed a partially successful performance regarding the title. Seckin Kapucu and Yurtseven Avci (2020) reached similar results and stated that pre-service teachers were able to present quality DS examples. The study conducted by Park et al. (2017) reported that in their DS experiences, pre-service teachers paid attention to issues such as music, visuality and creating the context. These achievements can be explained by young people's close connection with technology.

The participant products, digital stories, were examined in the context of SSI to answer the fourth research question. Evaluation of the SSI integrated into the digital stories according to the criteria in the literature showed that the participants were able to successfully transfer the theoretical information about the relevant SSI to their digital stories (Table 5). Integrating the theoretical part and prior knowledge into the story is partly independent of the participant's worldview or imagination. In this context, it can be argued that this part is easier. Therefore, the success of the participants in this area can be explained in this manner. The digital stories in the context of SSI should present positive and negative ideas or information about the subject in a balanced figure (Bosser & Lindahl, 2017). The results in Table 5 as a total score show that the participants wer partially successful in this regard. However, the individual data in Table 5 demonstrate that some participants were not completely unbiased while preparing their scenarios. While addressing the fourth research question, interview findings were examined along with participant products (Figure 4). It was concluded that most participants found DS preparation in SSI functional in the integration of SSI and DS. The participants emphasized that DS could be a method or teaching material that could be useful in SSI teaching. Since two research results were found in the literature addressing digital stories in the context of SSI, the current research findings can only be associated with the results of these two studies. The first of these studies (Park, et al., 2017) concluded that students were able to develop multiple perspectives and exhibit their creativity in areas such as

music and visual effects to express themselves, thanks to the DS prepared in the context of SSI. Based on these results, the researchers argue that DS can be an effective method in SSI teaching. Pre-service science teachers prepared digital stories in the context of SSI and presented their performances to secondary school students in the second study (Ozturk & Bozkurt Altan, 2018) addressing the relationship between SSI and DS. It was stated by the researchers that positive results were achieved in the study that revealed secondary school students' argument quality in SSI and pre-service teachers' DS experiences.

This study sought answers to the following question: "Is digital storytelling functional in teaching socioscientific issues?" In the framework of the study, digital stories were prepared individually by nine pre-service teachers on nine different socioscientific topics to find the answer to this question.

Based on the findings obtained from the pre- and post-interviews, the first data collection tool, it can be argued that the participants did not have knowledge and experience about DS before the implementation. At the end of the implementation, there were more positive opinions about DS in general. Participants who thought that the use of DS in the context of SSI was functional believed that the process would contribute to both the teacher and the student in many ways (technological, cognitive, affective, etc.).

In the current study, some of the participants who viewed SSI and DS integration positively mentioned the educational benefits and expressed concepts such as critical thinking and gaining different perspectives. In addition, the participants who stated that they had positive emotional experiences used words such as fun and exciting. The participants who stated that this process contributed to improvements in technological skills stated that they had more positive experiences. In support of the participant views, Matthews (2014) also predicts that DS can improve 21st century students' digital literacy skills. On the other hand, there are one or two participants in the study group who did not favor the use of digital stories in SSI and other science subjects and did not find DS functional. Participants who supported this view described digital stories as tedious, time-consuming and ineffective teaching materials.

The digital stories prepared by the participants were used as the second data collection tool in this study and they wereevaluated in line with the criteria in the literature. The discussion question in the digital story was the sub-dimension in which the participants had the lowest numerical average. In this part, the participants achieved a mediocre score. The fact that the discussion questions were either unproductive or inexistent in the digital story prepared by the participant, who had a subjective point of view, was both a striking and relevant result.

IMPLICATIONS

In this study, it was observed that most of the pre-service teachers in their 4th year at undergraduate education did not have DS experience before. It can be recommended to open undergraduate level courses so that pre-service teachers mayget to know and experience DS and other

technological applications much earlier. In addition, this study investigated the integration of DS and SSI with a small study group. The study obtained mostly positive experiences and results and the data were collected through DS and interviews. More generalizable results can be obtained in studies conducted with larger study groups. In addition, no intervention was made in this study to improve students' skills in the context of DS or SSI. By designing studies in an experimental design, studies can be conducted to improve students' skills in both key concepts (for example, creativity, argument quality, etc.) and contribute to the literature. In the current study, digital stories were prepared individually for the participants. In the implementation to be made, the participants can also be made to work in groups.

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APPENDIX

Pre-Implication Interview Questions

1. What do you know about digital storytelling?

2. Which socioscientific topic have you choosen in the digital storytelling process?

3. What is your level of knowledge about the socioscientific issue that you will prepare as a digital story?

4. Do you think that preparing a digital story on a socioscientific topic can contribute to you?

5. Do you think it might be difficult to prepare a digital story on a socioscientific issue?

6. What do you think about the digital story preparation process?

Post-Implication Interview Questions

1. Would you prefer to prepare digital stories as a teacher in your professional life? (Explain your reasoning)

2. In your professional life, would you prefer assignments (projects) related to preparing digital stories for your students? (If yes or no, please explain it)

3. How was the process of your digital story assignment? (Was it boring, enjoyable, interesting or hard?)

4. How did the digital story assignment (project) affect your perspective and interest in the lesson?

5. What were the positive aspects of preparing digital stories for you?

6. What were the negative aspects of preparing digital stories for you?

7. What kind of contribution does preparing a digital story on a socioscientific subject provide to you?

8. What do you think about the functionality of digital stories in teaching socioscientific issues? (Does it serve the purpose? If yes or no, please explain it)

GENİŞLETİLMİŞ TÜRKÇE ÖZET

DİJİTAL ÖYKÜLER SOSYOBİLİMSEL KONULARDA İŞLEVSEL Mİ?: ÖĞRETMEN ADAYLARININ DENEYİMLERİ

Teknolojideki gelişmelerin yaşantımıza etkileri her geçen gün artmakta ve özellikle alfa kuşağını çepeçevre sarmaktadır. Bilim ve teknolojinin ilerlemesi gündemdeki konuları, öğretim programları vb. birçok noktayı etkilemektedir. Bu bağlamda günümüz öğretmenleri uzay kirliliğinden, pandemik aşıya kadar birçok güncel, bilimsel ve bir o kadar da toplumsal konuları ele almak zorundadır. Sosyobilimsel konular (SBK) olarak adlandırılan ve bir tarafı sosyal bir tarafı bilimsel olan, ikilemler barındıran (Zeidler, Herman & Sadler, 2019) ve çözülmeyi bekleyen bu konular (nükleer enerji, biyoteknoloji, hidroelektrik santraller vb.) öğretim programlarında da giderek daha çok yer almaktadır (MEB, 2018). Yukarıda bahsedilen konuların çağdaş yaklaşımlar ve öğretim araçları eşliğinde yapılan öğretim faaliyetlerinin öğrenciler üzerinde daha etkili olacağı ifade edilebilir. Söz konusu yeni nesil öğretim araçlarından bir tanesinin dijital öykülerdir. Dijital Öyküler (DÖ) multimedya teknolojilerini kullanarak öğrenciye veya öğretmene kendisini ifade etme şansı veren yeni nesil öğrenme/öğretme araçları olarak tanımlanmaktadır (Robin, 2008). Alanyazında DÖ'nün fen eğitiminde kullanılabilirliğini dile getiren çalışmalar mevcuttur (Akgul, Tanriseven, 2019; Craciun vdiğ, 2016; Hoban, vd., 2015; Hung vd., 2012; Sancar Tokmak, vd., 2014) Ancak mevcut çalışmanın odağını oluşturan DÖ ve SBK'yi birlikte ele alan çalışmaların oldukça sınırlı sayıda olduğu görülmektedir (Ozturk & Bozkurt Altan, 2018; Park, vd., 2017). Gerek artarak öğretim programına dahil olan SBK'nın gerekse çağdaş öğretim raçlarından biri olan DÖ'nün nitelikli bir şekilde sınıf ortamına taşınabilmesinde öğretmenler anahtar rol oynamaktadır. Öğretmen adaylarının da eğitim sistemine dahil olmasına sınırlı zaman kaldığı düşünülürse eğitim fakültelerinde olabildiğince zengin deneyimler yaşaması ve güncel tekniklerden haberdar olması gerekmektedir. Bu noktadan hareketle çoğu öğretmen adayının daha önce tecrübe etmediği çağdaş bir uygulamayı mesleki yaşamalarına aşlamadan önce öğrencilik döneminde deneyimlemesinin yararlı olacağı düşünülmekte ve gençlerin potansiyellerinin gözlemlenmesi amaçlanmaktadır. Bu bağlamda mevcut çalışmanın alan yazına katkı sağlayacağı düşünülmekte ve "dijital öykülerin sosyobilimsel konuların öğretiminde işlevsel mi?" sorusuna cevap aramaktadır. Araştırma sorusu kapsamında bulunan dört alt amaç çerçevesinde çalışma tasarlanmıştır. Katılımcıların DÖ hazırlama sürecine yönelik beklentileri, DÖ hazırlama sürecine yönelik görüş ve deneyimleri, hazırlanan DÖ'nün niteliği ve SBK bağlamında DÖ'nün içerik ve niteliği alt amaçlardaki odak noktalarını oluşturmaktadır.

Araştırma nitel araştırma yaklaşımlarından eylem araştırmasına göre gerçekleştirilmiştir. Eylem araştırmalarında öğretmenin araştırma sürecine bizzat katılabilmesi ve okulu bir araştırma sahası haline getirebilmesi söz konusudur (Yıldırım & Şimşek, 2013). Araştırmada yer alan 21 katılımcı Türkiye'deki bir devlet üniversitesinde Fen Bilgisi Öğretmenliği Anabilim Dalı'nda 4. Sınıf düzeyinde öğrenim

görmektedir. 15 hafta süren çalışmanın başında ve sonunda katılımcılar ile görüşmeler yapılmıştır. Çalışmanın 2. ve 13. haftaları boyunca araştırmacı tarafından katılımcılara DÖ hakkında mentörlük hizmeti verilmiştir ve katılımcılar bu süreçte seçtikleri SBK ile ilgili DÖ hazırlamıştır.

Araştırmada veriler yarı yapılandırılmış mülakatlar (uygulama öncesi ve sonrası) ve katılımcı ürünleri (dijital öyküler) aracılığı ile toplanmıştır. Mülakatlar, katılımcıların dijital öyküleme sürecine yönelik deneyimlerini ortaya çıkarmayı amaçlamaktadır. Katılımcı ürünleri, hem öğretmen adaylarının süreci deneyimlemesine zemin hazırlamakta hem de hazırlanan ürünlerin alanyazındaki kriterlere göre değerlendirildiğinde "gerçekten dijital öykü" olup olmadığına dair araştırmacıya fikir vermektedir.

Görüşmelerin analizinde içerik analiz yöntemi kullanarak veriler analiz edilmiştir. Görüşmelerden elde edilen veriler transkript edilerek kod ve temalar oluşturulmuştur. Ardından bulguları ayrıntılı bir şekilde görebilmek adına araştırmacı tarafından matrisler oluşturulmuştur. Dijital öykülerin değerlendirilmesi aşamasında ise betimsel analiz yöntemine yer verilmiştir. DÖ'nün niteliği incelenirken katılımcıların hazırladığı dijital öyküler alanyazındaki kriterler baz alındığında "gerçek bir dijital öykü" olabilmiş midir? sorusu ekseninde analizler yapılmıştır. Bu cevabı bulabilmek için Sadik (2008) tarafından geliştirilen DÖ değerlendirme rubriği kullanılmıştır. Katılımcı ürünleri "gerçek bir dijital öykü olabilmişse sosyobilimsel konulara uygun şekilde entegre edilebilmiş midir?" sorusunu cevaplayabilmek için de Atabey, Topçu ve Çiftçi'nin (2018) çalışmalarındaki kriterler baz alınmıştır.

Verilerin analizi aşamasında fen eğitiminde ve nitel analizde uzman niteliğinde bir başka araştırmacıdan (bağımsız puanlayıcı) yardım alınmıştır. Transkriplerin yarısını inceleyen bağımsız puanlayıcı ile araştırmacı arasında Miles ve Huberman'ın (1994) görüş birliği/ görüş ayrılığı formülüne göre %92 oranında görüş birliği sağlanmıştır. Mevcut araştırmada inandırılabilirlik ve aktarılabilirliğin sağlanabilmesi için araştırma süreci okuyucuya detaylı olarak açıklanmaya çalışılmıştır. Ayrıca zaman zaman katılımcıların ham verilerinden örnekler bulgular bölümünde alıntılar halinde sunulmuştur.

Birinci veri toplama aracı olan ön ve son mülakatlardan elde edilen bulgular genel olarak değerlendirildiğinde katılımcıların uygulama öncesinde DÖ'ye dair bilgi ve deneyimlerinin olmadığı söylenebilir. Uygulama sonunda ise DÖ'ye dair genel olarak olumlu görüşlerin de daha fazla olduğu sonucuna ulaşılabilir. DÖ'nün eğlenceli, etkileyici ve öğretici olduğunu dile getiren katılımcılar çoğunlukla yer alırken az sayıda katılımcı da DÖ'nün zahmetli ve zaman alıcı bir öğretim materyali olduğunu ifade etmektedir.

DÖ'nün SBK bağlamında ele alındığında katılımcılar SBK gibi çok boyutlu konularda DÖ sayesinde bütüncül bakılabildiğini ifade etmektedir. DÖ kullanılmasının işlevsel olduğunu düşünen katılımcılar birçok açıdan (teknolojik, bilişsel, duyuşsal vb) hem öğretmene hem de öğrenciye katkı sağlayan bir süreç olduğuna inanmaktadır.

İkinci veri toplama aracı olan katılımcı ürünlerinden (dijital öyküler) elde edilen bulgularda katılımcıların DÖ içeriğini belirleme, kaynak kullanımı, konuyu müfredat içeriğine (düzeyine) uyarlama ve geçişleri sağlamada da başarılı örnekler sunabilmişlerdir. Dil, kamera ve resim seçme konusunda kısmen başarılı olan katılımcılar SBK'da bakış açısını gösterme/göstermeme boyutunda da kabul edilebilir orta düzeyde performans göstermiştir. Ayrıca katılımcıların DÖ'de ilgili SBK hakkında teorik bilgileri başarılı bir şekilde senaryoya dahil edebildiği görülmektedir.Ancak bazı katılımcıların dijital öykülerinde ele aldıkları SBK'yı tarafsız bir şekilde ele alamadığı ve olumlu ya da olumsuz noktaları öykülerine yansıtırken kısmen subjektif davrandığı yorumuna ulaşılabilir. Olumlu ve olumsuz noktalar kendi içinde ayrı ayrı ele alındığında katılımcıların kabul edilebilir ve orta düzeyde başarı gösterdiği söylenebilir.

Araştırma sonuçları genel olarak değerlendirildiğinde katılımcılar tarafından genel olarak yaşanan süreç olumlu bir deneyim olarak algılansa da bazı sıkıntılar ile karşılaşıldığı söylenebilir. Sancar Tokmak ve arkadaşları (2014) tarafından yapılan çalışmada öğretmen adaylarının öykü oluşturma sürecinde çok zorlandığı, katılımcıların yaratıcı düşünme ve görsel materyaller oluşturmada sıkıntı yaşadığı sonucuna ulaşılmıştır. Bahsedilen sıkıntılardan dolayı katılımcıların çoğu mesleki yaşamlarında dijital öykülemeye yer vereceğini ancak öğretmen olarak DÖ'yü bizzat kendilerinin hazırlayacağını ifade etmektedir.

Katılımcılar tarafından hazırlanan DÖ alanyazındaki kriterler doğrultusunda değerlendirilmiş ve genel olarak katılımcı ürünleri başarılı bulunmuştur. Seçkin Kapucu ve Yurtseven Avcı (2020) da benzer sonuçlara ulaşarak öğretmen adaylarının nitelikli DÖ örnekleri sunabildiğini belirtmiştir. Söz konusu başarı örnekleri genç yaştaki öğretmen adaylarının teknoloji ile sıkı bağ kurması ile açıklanabilir. SBK ile DÖ entegrasyonunda çoğu katılımcının SBK'de DÖ hazırlamayı işlevsel bulduğu sonucuna ulaşılmıştır. Katılımcılar tarafından SBK öğretiminde DÖ'nün amaca hizmet edebilecek bir öğretim materyali olabileceği vurgulanmıştır. Park, vd. (2017) SBK bağlamında hazırlanan DÖ sayesinde öğrencilerin çoklu bakış açıları geliştirebildiği ve kendilerini ifade etmek için müzik, görsel efect gibi noktalarda yaratıcılıklarını sergilediği sonucuna ulaşmıştır.

Mevcut araştırmada küçük bir çalışma grubu ile DÖ ve SBK entegrasyonuna bakılmıştır. Çoğunlukla olumlu deneyimlerin ve sonuçların elde edildiği çalışmada DÖ ve mülakatlar aracılığı ile veriler toplanmıştır. Daha geniş çalışma grupları ile yapılan araştırmalarda temsil gücü yüksek sonuçlar elde edilebilir. Ayrıca bu araştırmada öğrencilerin DÖ yada SBK bağlamındaki becerilerini geliştirebilmek adına müdahalede bulunulmamıştır. Deneysel desende çalışmalar tasarlanarak öğrencilerin her iki anahtar kavramdaki becerilerini (örneğin yaratıcılık, argüman niteliği vb.) geliştirmek adına çalışmalar yapılarak alanyazına katkı sağlanabilir.