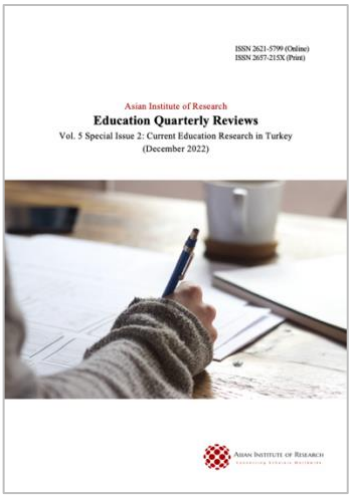

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Pre-service Teachers' Views on the Process of Designing Activities through Cartoons

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Abstract
Cartoons are an effective alternative to create a rich learning environment that is visually and audibly equipped for students in an effective science education. It is of upmost significant for science teachers to possess the necessary knowledge, activity experience and equipment in order to carry out a qualified science teaching. Therefore, the pre-service science teachers, who will be trained in the specified direction, should hold a certain level of knowledge, skills and experience in preparing and implementing activities. In this regard, this study aims at revealing the pre-service science teachers' views on the process of designing activities through using cartoons. The study was carried out with 14 fourth grade pre-service science teachers studying at a state university in Turkey. The cartoon that the pre-service teachers were requested to use to design in-class activities during the implementation was determined as "Ege and Gaga" on the "TRT Child" channel. That this cartoon is related to education and science and includes science subjects has been effective in its selection. This study employed a case study design, one of the qualitative research methods, and the data were collected through a semi-structured interview form. Content analysis was used during data analysis. The results suggested that no pre-service teachers had encountered an activity prepared through using cartoons before. The participants also had positive views on the activity design process such as effective, interesting, enjoyable, concretizing knowledge and alternative technique. These activities, which are appropriate for the teaching and traditional classroom environments, are expected to enable students to access knowledge more easily with pleasure, and thus contributing to learning.

Keywords: Pre-service science teachers, Cartoons, Preparing an Activity, View

1. Introduction

Science is considered as a remarkable field in contributing to the development of societies by making life easier. Therefore, a science teacher should endeavour to improve himself in conjunction with current curricula as well as social and scientific developments. The need to prepare and implement new and engaging activities in the lessons particularly in line with technological developments prompts teachers to think in a multi-dimensional way. A teacher mediating to create an effective learning environment concentrates on attracting students' attention and interest through using all available opportunities and materials (Gökçe, 2002). On that point, the teacher should carry out in-class teaching by preparing the appropriate activity. Sullivan, et al. (2009) implicated that teachers should have the necessary knowledge and equipment in order to pose activities effectively that require higher-level process skills such as reasoning and association. Hence, pre-service science teachers are expected to improve themselves in accord with social and technological advances in the educational process.

Undoubtedly, education faculties hold the most important task in teacher training. It is of upmost significance for instructors to provide an environment for students to prepare and test the activities that they can use in their professional lives. In this regard, pre-service science teachers are supposed to produce original ideas that adapt to today's conditions as well as products from these ideas depending on environment and conditions. Besides, they need to have the 21st century skills along with problem-solving skills (Kendaloğlu, 2021). Pre-service teachers who will be trained in this direction should also have a certain level of knowledge, skills and experience in preparing and implementing activities (Özgen & Alkan, 2014) so as to be beneficial for students to develop cognitively (Okumuş, 2021).

"While choosing learning-teaching and evaluation activities in science lessons, great attention should be paid so that individuals can gain the behaviours identified in the learning outcomes through discovery by using scientific process skills such as questioning, gathering information, observing, and interpreting data." (MoNE, 2005). In this respect, it is of great importance to prepare activities that are appropriate for the accepted learning approach, model and the learning objectives within the scope of the course (Üçüncü et al., 2016). Waldrip et al. (2010) revealed a strong relation among students' meaning-making processes in science lesson activities. Similar studies suggested that activity-based teaching contributes positively to students' academic achievement, cooperation and problem-solving skills and attitudes towards the course (Barai, 2018; Batdı, 2014; Bozkurt & Kuran, 2016; Büyükbayraktar Ersoy & Dilber, 2016; Hussain et al., 2011; Koohang et al., 2009; Kyriazis et al., 2009; Lakshmi & Hee, 2005; Okoro, 2019; Shah & Rahat, 2014).

In an effective science education, cartoons are considered as one of the best alternatives to create a rich and visually equipped learning environment for students. A visual communication tool, the main objective of the cartoon is to simplify the complex and visualize the invisible as well as providing an effective teaching. Thus, it is absolutely based on a message. Cartoons use a more humorous and pleasant language for the needs of the target audience when conveying the message (Güler, 1989). Providing that cartoons are prepared by considering children's ages and developmental characteristics, supporting their multidimensional development and by consulting the pedagogues' views and suggestions, they can be used for education in addition to entertainment.

Numerous studies conducted in recent years concluded that cartoons are used as teaching materials in different disciplines and welcomed as an educational material in education (Borzekowski, 2018; Kanellidou & Zacharia, 2019; Vitasmoro, et al., 2020). Cartoons, which are regarded as an effective and useful tool that provide better understanding by visualizing (Barak et al., 2011), contribute to teachers showing more concepts in less time (Banchonhattakit et al., 2015; Chan, 2015). Upon analyzing the relevant literature, there is a dearth of studies conducted on the use of cartoons in the education process (Awadh et al., 2014; Bieri et al., 2013; Dalacosta et al., 2009; Indradat et al., 2014; Sohn et al., 2013; Berber et al., 2019; Çelik, 2015; Aytekin, 2020; Yener et al., 2021; Yurt & Ömeroğlu, 2013). Ayvacı et al. (2012) implied that the use of cartoons in science education increases children's achievement scores. Likewise, Yurt and Ömeroğlu (2013) emphasized that cartoons provide support for students to learn science subjects. Besides, studies carried out with teachers and pre-service teachers concluded that cartoons are useful and inspirational in teaching (Bayındır, 2015; Berber et al., 2019; Özeskici, 2014; Sancak, 2018).

Considering the studies conducted with pre-service teachers, there is no such a study specifically published on designing an activity through using cartoons. Thus, this study is paramount in terms of addressing further studies. Aiming at examining the views of the pre-service science teachers on the process of designing activities using cartoons, the present study is also substantial in terms of providing pre-service science teachers with acquiring knowledge and skills during the process of designing activities through integrating cartoons with the content of science concepts into the lessons. In a similar vein, this study is expected to shed light onto revealing the pre-service science teachers' views regarding the activity preparation process.

1.1 Aim of the Study

This study sought to examine the pre-service science teachers' views on the process of designing activities through using cartoons.

Hence, the research question is; What are the pre-service science teachers' views on the process of designing activities through using cartoons?

2. Method

This study employed a case study design, one of the qualitative research methods. The study analysed the cases related to the situation with a holistic approach and identified how they were affected by the situation (Yıldırım & Şimşek, 2008). The case study is the study of understanding the activity within all its circumstances and providing in-depth information regarding the activity (Merriam, 1998). Thus, this study deployed the case study design since the pre-service science teachers' views on the process of designing activities through using cartoons were examined.

2.1 Working Group

Qualitative research is usually conducted in-depth on purposefully selected relatively small samples (Patton, 2002). The working group of this study consisted of the 4th grade pre-service science teachers (14) studying at a state university in Turkey. The participants were chosen by convenience sampling, which is a purposive sampling method. Because this sampling method selects a situation that is close and easily available by giving the researcher practicality and speed (Yıldırım & Şimşek, 2008). The working group held senior pre-service science teachers as the knowledge, skills and experiences related to preparing and implementing activities in the research are thought to be at a certain level. Besides, the volunteering principle was taken into consideration when determining the working group and the names of the pre-service teachers, 4 of whom were males and 10 females, were kept confidential, and hence they were named with codes as PT1, PT2, PT3…

2.2 Data Collection Tools

The present study deployed a semi-structured interview form to reveal the pre-service science teachers' views on the activity design process. The cartoon that the pre-service teachers were requested to use to design in-class activities during the implementation was determined as "Ege and Gaga" on the "TRT Child (Turkish Radio and Television Corporation Child, 2022)" channel. "Ege and Gaga" is an entertaining cartoon that conveys questioning and the pursuit of knowledge to children in a gripping style. In addition, "Ege and Gaga" includes science subjects and concepts, arouses interest in science; moreover, it is thought to be beneficial for developing children's creativity. This cartoon was preferred by the researcher since it was related to education and science, and included science subjects. The cartoon episodes used in the implementation process were determined via the "TRT Child" channel's website (https://www.trtcocuk.net.tr/). The semi-structured interview form used for the cartoon activity design process was prepared by analysing the relevant literature and consulting two science education experts. The interview questions were administered to 7 pre-service science teachers, apart from the working group, to ensure that the questions were clear and understandable. Necessary corrections were made after receiving the same experts' views and the form got its final version. The semi-structured interview form consists of 8 open-ended questions.

2.3 Data Analysis

Content analysis was used during data analysis. Content analysis is a process that begins with data collection and ends with category and code extraction, and that the interpretation and synthesis of data are conducted by researchers (McMillan & Schumacher, 2006). All interviews were conducted via a voice recorder with the permission of the participants. The records were converted into text by the researcher. Afterwards, codes were created; similar codes were brought together, categorized and presented in tables. In content analysis, similar data are brought together within the framework of certain concepts and themes, and they are arranged and interpreted in a way that the reader can understand (Yıldırım & Şimşek, 2008). While creating the codes and categories, correct and reliable findings were obtained by consulting a science education expert who was not included in the research process. Besides, the validity was ensured with direct quotations to reflect the views of the pre-service teachers.

2.4 Implementation Process

The episodes of the cartoon "Ege and Gaga" on TRT Child channel were initially watched and examined by the researcher until the end. The episodes in the cartoon were identified across the grade level and learning outcomes. Two science teachers and a science education expert were consulted when determining the grade level and learning outcomes of the cartoon content. Of all the selected cartoons, four cartoons at different grade levels were chosen by taking the views of a science teacher and a science education expert into consideration. The pre-service teachers were informed about the research process and the implementation was conducted with volunteers. The implementation lasted approximately five lesson hours. At the first meeting, volunteer pre-service teachers were informed about the considerations they should pay attention to in the process of designing cartoon activities with some examples of the activities in the relevant literature and textbooks. Afterwards, the cartoons at each grade level were presented to the pre-service teachers to design activities. Thus, each pre-service teacher was ensured to choose the cartoons for the activity by himself or herself. Table 1 depicts information regarding the grade level, subject area and learning outcomes of the cartoons determined by the researcher with the support of field experts.

Table 1: Science learning outcome contents of cartoon episodes

Cartoon Episode	Grade Level	Subject Area	Unit	Learning outcome	Internet Address
93rd episode: Shadow Play	5th grade	Physical Phenomena	Scattering of Light	F.5.5.4.1. The student demonstrates with simple ray drawings by observing how the full shadow is formed.	https://www.trtcocuk.net.tr/video/ege-ile-gaga-93
62nd episode: Is it tasteless?	6th grade	Living Beings and Life	Systems in Our Body	F.6.6.2.2. The student demonstrates the relationship between the senses of smell and taste with an experiment s/he designed.	https://www.trtcocuk.net.tr/video/ege-ile-gaga-62
46th episode: Black and White	7th grade	Physical Phenomena	Interaction of Light with Matter	F.7.5.1.1. The student discovers that light can be absorbed by matter as a result of its interaction with matter.	https://www.trtcocuk.net.tr/video/ege-ile-gaga-46
82nd episode: Land of the Clouds	8th grade	Earth and the Universe	Seasons and Climate	F.8.1.2.1. The student explains the difference between climate and weather events.	https://www.trtcocuk.net.tr/video/ege-ile-gaga-82

Upon analysing Table 1, the "Shadow Play" episode of the outcome content in the "Physical Events" subject area "Scattering of Light" unit was used for the 5th grade, and “Is it tasteless?” episode "Living Beings and Life" subject area, the "Systems in Our Body" unit for the 6th grade, the "Black and White" episode of the outcome content in the "Physical Phenomena" unit of the "Interaction of Light with Matter" for the 7th grade and “Land of the Clouds”

episode of the outcome content in the "Seasons and Climate" unit of the "Earth and the Universe" subject area for the 8th grade. The researcher examined the activities designed in the second meeting with the pre-service teachers. Missing and badly organized activities were determined and necessary feedbacks were presented, and finally, the pre-service teachers were asked to finalize their activities. At the last meeting, the cartoon activities prepared by the pre-service teachers were presented in the classroom environment to get their colleagues' views. Some of the cartoon activity examples prepared by pre-service science teachers are shown in the Appendix.

3. Results

This section presents the data related to the pre-service science teachers' views regarding the process of designing activities through using cartoon.

3.1 Findings regarding the pre-service science teachers' views on the process of designing activities through using cartoons

A semi-structured interview form prepared by the researcher was used to reveal the pre-service science teachers' views on the process of designing the cartoon activity. Considering the findings related to the question "Have you encountered any lesson activities prepared through using cartoons before? If your answer is "Yes", give an example.", none of the pre-service teachers were determined to experience such an activity.

Table 2 depicts the findings related to the question "How would you evaluate the implementation of designing an activity through using cartoons?"

Table 2: Evaluation of the pre-service teachers' cartoon activity design process

Category	Code	*f*
Positive	Effective	9
	Interesting	6
	Enjoyable	5
	The process of concretizing knowledge	4
	Alternative technique	3
Negative	Takes a long time to prepare	1

Table 2 displays that the pre-service teachers had both positive and negative views towards the activity design process. Accordingly, they were noted to use positive expressions such as effective (*f*=9), interesting (*f*=6), enjoyable (*f*=5), the process of concretizing knowledge (*f*=4) and alternative technique (*f*=3) with regard to activity design process. Besides, a pre-service teacher had a negative view on the activity design process as it took a long time. Some of the pre-service teachers' views are as following:

PT14 "It would be a very effective implementation for students."
PT3 "I believe that we can make education more fun by using it within educational process."
PT3 "It took me a long time to prepare the questions I would ask while preparing the cartoon lesson activity, and the implementation took a long time."

Table 3 summarizes findings related to the question in the semi-structured interview form, "What would you like to say if you evaluate yourself during the activity design process?".

Table 3: Self-evaluation of the pre-service teachers' cartoon activity design process

Category	Code	*f*
Positive	I did not have much difficulty	7
	I discovered new things	3
	I have had experience	2
	Do research	2

	I learned my shortcomings	2
Negative	Time-consuming	1

As in Table 3, when pre-service teachers evaluated themselves in the activity design process, they had such views as I did not have much difficulty (*f*=7), I discovered new things (*f*=3), I learned my shortcomings (*f*=2), I did research (*f*=2), I have had experience (*f*=2). In addition, a pre-service teacher expressed a negative view by stating that the process of designing an activity is time-consuming. Some of the pre-service teachers' views are presented as follows:

PT8: "I did not have much difficulty in the process of designing an activity; on the contrary, I prepared it with pleasure. I was very motivated while watching cartoons and preparing activities since the process attracted my attention just as students and I discovered new things."
PT10: "I thought about how I could teach the most effectively and most meaningfully, or how I could ask attention-grabbing questions during the process of designing an activity. I may be a little incompetent in preparing comprehensive and creative questions. However, I had a lot of fun while preparing it and I gladly did it."

The findings related to the question in the semi-structured interview form, "What is the contribution of the process of designing activities through using cartoons to you? Please explain." are depicted in Table 4.

Table 4: The contribution of cartoon activity design process to the pre-service teachers

Category	Code	*f*
Positive	Enriching the lesson	7
	Designing new things	7
	Using cartoons in the lesson	6
	Doing research	4
	Writing questions for revealing the skill	4
	Visualizing the lesson	3
	Preparing level-appropriate questions	2
	Associating daily events with the lesson	2

As is seen in Table 4, the pre-service teachers had positive views regarding the contributions of the cartoon activity design process. Hence, the emerging codes were identified as enriching the lesson (*f*=7), designing new things (*f*=7), using cartoons in the lesson (*f*=6), doing research (*f*=4), writing questions for revealing the skill (*f*=4), visualizing the lesson (*f*=3) and associating daily events with the lesson (*f*=2). Here are some excerpts from the pre-service teachers' views:

PT2: "I learned to design new things by enriching the course. I was impressed that cartoons could also be used in lessons."
PT6: "This process made me gain experience in preparing comprehensive and level-appropriate questions to develop skills."

Table 5 highlights the findings regarding the question "What kind of learning environment do you think will be created when the cartoon activity you have prepared is implemented? Why?"

Table 5: Pre-service teachers' views on the cartoon activity implementation learning environment

Category	Code	*f*
Positive	Effective learning environment	9
	Learning with fun	2
	Permanence	1
	Active participation	1
	Increasing interest in the lesson	1
	Engaging	1

According to Table 5, given that all the pre-service teachers used the cartoon activities they had prepared, they were found to express positive views about the learning environment. In this regard, the codes were determined as effective learning environment (*f*=9), fun learning (*f*=2), engaging (*f*=1), permanence (*f*=1), active participation (*f*=1) and interest in the lesson (*f*=1). Some of the pre-service teachers' views on the learning environment are as following:

PT10: "I assume it will be an effective learning environment as learning will be effective and fun for the teaching environment."
PT3: "I think an effective environment will be created. It will ensure students' active participation in the lesson. Students' interest and attention in the lesson will increase thanks to cartoons."

Table 6 presents the findings related to the participants' responses to the question, "What are the considerations you pay attention to while designing the activity? Explain with reasons.".

Table 6: The pre-service teachers' views regarding the considerations they paid attention to while designing a cartoon activity

Category	Code	*f*
Student	Grade-appropriate	7
	Revealing prior knowledge	5
	Getting student attention	3
	Active student	2
Purpose	Appropriate for learning outcomes	5
	Revealing misconceptions	3
	Using time efficiently	1
	Increasing retention	1
The structure of the activity	Asking questions in appropriate time	3
	Suitability for daily life	3
	Questions revealing skills	2
	Questions are clear	2
	Intriguing questions	2
	Query	2
	Visual layout	1

Upon analysing the pre-service teachers' views on the considerations, they paid attention to while designing the activity, they were found to mostly emphasize the student, purpose and structure of the activity. The pre-service teachers were determined to design the activity by considering the student factor at the most level. This was followed by grade-appropriate (*f*=7), revealing the prior knowledge (*f*=5), getting the students' attention (*f*=3) and active student (*f*=2). When the purpose category, one of the considerations that pre-service teachers paid attention to while designing the activity, was examined, the emerging codes were appropriate for learning outcomes (*f*=5), revealing misconceptions (*f*=3), efficient use of time (*f*=1) and increasing retention (*f*=1). Finally yet importantly, some codes related to the structure of the activity were determined as being suitable for daily life (*f*=3), asking questions in appropriate time (*f*=3), being inquisitive (*f*=2), questions revealing skills (*f*=2), clarity of questions (*f*=2), intriguing questions (*f*=2) and visual layout (*f*=1). Some of the pre-service teachers' views on that point are presented as such:

PT14: "The consideration I mostly paid attention to was the purpose. In other words, "What do I aim to transfer with this activity?" Then, I made sure that it was appropriate for the student. (Student's readiness, grade level, psychomotor skills, affective, cognitive skills…)"
PT3: "The most important point I paid attention to was the questions I would ask the students. Because I needed to attract the students' attention in the questions I was going to ask, and I tried to pay attention to the questions I would ask in order to ask complex questions."

Table 7 demonstrates the findings with regard to the question in the semi-structured interview form, "Which skills do you think the students will gain when the activity you have designed is implemented?"

Table 7: Pre-service teachers' views on the skills that students will gain when the activity they have designed is implemented

Category	Code	*f*
Scientific Process Skills	Predicting	7
	Observing	6
	Questioning	4
	Testing the data	3
	Designing an experiment	3
	Changing variables	2
	Hypothesizing	2
	Drawing conclusion	2
	Inferencing	1
	Interpreting data	1
Life Skills	Analytical thinking	3
	Creative thinking	2
	Decision making	1
21st Century Skills	Critical Thinking	3
	Problem solving	3
	Digital literacy	1
	Interdisciplinary association	1

On analysing Table 7, the pre-service teachers' views on the skills that students would acquire when the activity they had designed was implemented were categorized as scientific process skills, life skills and 21st century skills. Accordingly, the emerging codes in relation to science process skills included making predictions (*f*=7), making observations (*f*=6), questioning (*f*=4), testing data (*f*=3), designing experiments (*f*=3), changing variables (*f*=2), hypothesizing (*f*=2), drawing conclusions (*f*=2), interpreting the data (*f*=1) and making inferences (*f*=1). When examining the pre-service teachers' views on life skills, they were found to emphasize that analytical thinking (*f*=3), creative thinking (*f*=2) and decision-making (*f*=1) skills were those that students would gain when the activity is implemented. As for the 21st century skills category, the pre-service teachers noted problem solving (*f*=3), critical thinking (*f*=3), interdisciplinary association (*f*=1) and digital literacy (*f*=1) skills. Some of the pre-service teachers' views are as following:

PT2: "I think it will provide skills such as research, questioning, making predictions, designing experiments, reasoning, engineering design skills, making hypotheses, making observations, correlational thinking, changing variables, making decisions and making inferences."
PT10: "I think that students can gain problem-solving skills, research skills, questioning skills, decision-making and reasoning skills as well as critical thinking skills."

Table 8 shows the findings on the question "Did you have any difficulties while designing activities through use of cartoons? Please explain."

Table 8: Pre-service teachers' views regarding the difficulties they have experienced in designing activities through cartoons

Category	Code	*f*
Yes	Preparing questions suitable for the content	5
	Preparing questions for developing skills	3
	Determining the learning outcome	3
	Dividing cartoons into episodes	2
	Content preparation	2
	Grade level	1

No	I haven't had difficulty	3

According to Table 8, 11 of the pre-service teachers had difficulties in the process of designing the activity. In this context, the emerging codes were preparing questions appropriate for the content (*f*=5), determining the learning outcome (*f*=3), preparing a question revealing skills (*f*=3), dividing the cartoon into episodes (*f*=2), preparing the content (*f*=2) and grade level (*f*=1). On the other, three pre-service teachers implicated that they had no difficulty in the process of designing the activity. Some of the pre-service teachers' views are presented below:

PT9: "I had some difficulty in choosing the right scenes in order to achieve my aim in the activity that I prepared through using cartoons. Since the learning outcomes were related to each other, I had some difficulty in determining which learning outcome the cartoon would be most suitable. Afterwards, I had to ask the most appropriate questions in the episodes I chose. It was a bit of a challenge to ask the right question in line with my goals on the subject."
PT5: "I was able to do the activity comfortably without any difficulty."

The findings related to the question "Do you consider preparing an activity by using cartoons in your teaching life? Why?" are suggested in Table 9.

Table 9: The pre-service teachers' views on preparing cartoon activity

Category	Code	*f*
Yes	Interest in the lesson	5
	Increasing students' motivation	5
	Permanence	4
	Fun learning	4
	Engaging	3
	Active learning environment	2
	Effective learning	2
	Revealing prior knowledge	1
	Research-inquiry	1
	Exploring	1
	Designing	1
	Science process skills	1
	21st century skills	1
	Achieving the learning goal	1
	Learning with differences	1
	Efficient learning	1
	Meaningful learning	1
	Technology-aided	1
No	Waste of time	1
	Student participation	1

As in Table 9, 13 of the pre-service teachers stated that they would prepare a cartoon activity when they became teachers. In this regard, increasing the interest in the lesson (*f*=5), increasing the students' motivation (*f*=5), ensuring the permanence (*f*=4), creating a fun learning environment (*f*=4), attracting the students' attention (*f*=3) and creating an active learning environment (*f*=2) were identified as the emerging codes with regard to preparing cartoon activity. Only one of the pre-service teachers indicated that s/he would not use the cartoon activity as it was time consuming and could not ensure student participation. Some of the pre-service teachers' views are as such:

PT5: "Yes, I think that it will increase the interest and motivation towards the course as it provides a platform that offers students a multimedia as a course material. I consider that it can be more efficient in conveying knowledge, especially in abstract concepts."
PT12: "I do not think because it will cause a lot of waste of time, and I doubt that each student will fully participate."

4. Discussion

This study is an attempt to examine the pre-service science teachers' views on the process of designing activities through using cartoons. The episodes of the cartoon "Ege and Gaga", which were broadcast on TRT Child, with science content at different grade levels determined by the researcher, were presented to the pre-service teachers. These episodes are "Shadow Theatre" for Grade 5, "Is it Tasteless?" for Grade 6, The "Black and White" for the 7th Grade and the "The Land of the Clouds " for the 8th Grade. The pre-service science teachers were requested to design an activity by choosing one of these cartoons. Afterwards, a semi-structured interview form was deployed to reveal their views on the process of designing the activity through cartoons.

All of the pre-service teachers implied that they had not encountered an activity prepared using cartoons before. The results suggested that the pre-service teachers had positive views on the activity design process such as effective, interesting, enjoyable, process of concretizing knowledge and alternative technique; moreover, some negative views also emerged related to the fact that the design took a long time. Upon analysing the relevant literature, some studies suggested that cartoons can be used during education as they are interesting and engaging (Bayındır, 2015; Özeskici, 2014; Sancak, 2018). In addition, the literature shows that cartoons urge students to discover new concepts, provide possible answers to daily life questions and participate in classroom discourse, as well as increasing their motivation for learning science (Barak et al., 2011). Dalacosta et al. (2009) concluded that cartoons are quite effective in helping children form some basic science concepts such as weight, mass, and gravity.

The results also demonstrated that the pre-service science teachers had positive views on the contribution of the cartoon activity design process. In this vein, they highlighted some points such as enriching the lesson, designing new things and integrating cartoons into the lessons. When pre-service teachers evaluated themselves during the activity design process, they were determined to have positive views as such: I didn't have much difficulty, I discovered new things, I learned my shortcomings, I did research, I have had experience. The emerging codes related to the implementation of the cartoon activities prepared by all the pre-service teachers were identified as effective learning environment, fun, remarkable, permanence, active participation and interest in the lesson. In the study conducted by Berber et al. (2019), the pre-service teachers stated that fun learning environments will be created and the lessons will be conducted in an entertaining way with the use of cartoons in science lessons. Besides, similar studies indicated that children's imagination will develop with cartoons, that they will enjoy the teaching process, and that their desire to learn will increase (Aşçı, 2006).

The pre-service teachers were noted to mostly prepare the cartoon activity by considering the students, the purpose and the structure of the activity. Scientific process skills, life skills and 21st century skills were found when the pre-service teachers' views on the skills that the students would acquire when the activity they had prepared was implemented. 11 of the pre-service teachers had difficulty in preparing questions suitable for the content, determining the learning outcome, preparing questions that reveal skills, dividing the cartoon into episodes, preparing content, grade-level during the process of designing the activity. 13 of the pre-service teachers confirmed that they would prepare a cartoon activity to increase interest in the lesson, student motivation and permanence when they became teachers. Koçak and Göktaş (2021) concluded that educational cartoons provide more permanent learning in concept teaching compared to traditional methods. Ayvacı et al. (2012) noted that the use of cartoons in science education increases children's achievement scores. Numerous studies demonstrated that the use of cartoons as teaching materials has a positive effect on achievement (Aytan & Tunçel, 2015; Çelik, 2015; Ekinci, 2017; Oruç & Teymuroğlu, 2016). Besides, visual branches such as cartoons and animation easily attract children's attention and have the task of educating as well as entertaining (Aşçı, 2006; Kaba, 1992).

5. Suggestions

Based on the research findings, various recommendations were provided:

- Applied training should be provided for the development of the pre-service teachers' knowledge and skills in designing activities.
- The pre-service science teachers who encountered cartoon activity design for the first time were identified to have difficulty in preparing questions suitable for the content of the cartoon. Therefore, they should have the opportunity to do such activities more often during their educational process.
- Pre-service teachers may be recommended to prepare activities through using different cartoons appropriate for science content.
- Pre-service teachers may be encouraged to prepare activities in the Teaching Practice course to gain experience in the cartoon activity preparation process.
- Research may be conducted on identifying and eliminating the difficulties of the pre-service science teachers in designing cartoon activities.
- The relevant literature may be enriched by conducting similar studies.

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Appendix: Examples of activities prepared by pre-service science teachers

Seçtiğim çizgi film	https://www.trtcocuk.net.tr/video/ege-ile-gaga-46 **Siyah Ve Beyaz**
Ders Adı	Fen Bilimleri
Sınıf	7.Sınıf
Ünite Adı / No	Işığın Madde İle Etkileşimi/ 5
Konu Adı	Işığın soğurulması
Kazanım	F.7.5.1.1. Işığın madde ile etkileşimi sonucunda madde tarafından soğurulabileceğini keşfeder.

ETKİNLİK KAĞIDI

1-) Sizce gaganın mavi balonunun benekleri çizmeden önce patlamayıp da, çizerken patlamasının nedeni ne olabilir? (3.35 'inci dakikada durdururum ve bu soruyu sorarım.)

2-) Sizce gagasının siyah balonunun üstüne benek çizilmediği halde patlamasının sebebi ne olabilir?(Çizgi filmi 4.38 'inci dakikada durdururum ve bu soruyu sorarım.)

3-) Sizce gagasının beyaz balonunun şişirildikten sonra hemen patlamayıp da, siyah balonunun hemen patlamasının sebebi ne olabilir? (Çizgi filmi 6.51 'inci dakikada durdururum ve bu soruyu sorarım.)

4-) Sizce gagasının beyaz balona büyüteçle baktığında patlamamasının nedeni ne olabilir? (Çizgi filmi 6.55 'inci dakikada durdururum ve bu soruyu sorarım.)

ETKİNLİK PLANI

Etkinliğin Adı: Ege ile Gaga - Tatsız mı?

Ders: Fen Bilimleri

Ünite/Konu: Vücudumuzdaki Sistemler ve Sağlığı/ Duyu Organları

Kazanım: F.6.6.2.2. Koku alma ve tat alma duyuları arasındaki ilişkiyi, tasarladığı bir deneyle gösterir.

Öğrenci Becerileri: Tahmin Etme, Muhakeme Becerisi, Problem Çözme Becerisi , Gözlem yapma Becerisi

Çizgi film linki: https://www.trtcocuk.net.tr/video/ege-ile-gaga-62

- Bağlantıda verilen Ege ile Gaga çizgi filmi izletilir. Ve aşağıda verilen sürelerde video durdurulur ve sürelerin karşısındaki sorular sorulur.

01:47- Geçmiş yıllarda duyu organlarını ve özelliklerini öğrenmiştiniz. Peki o bilgilerden yola çıkarak meyve tabağındaki meyveleri gözlemleyelim. Meyve tabağında; erik, çilek ve kiraz bulunmaktadır. Peki bu meyve tabağında hangi meyvelerin bulunduğunu, gözlerimiz bağlı iken hiçbir güçlük çekmeden söyleyebilir misiniz?

Cevabınız "evet" ise hangi duyu organınızı kullanarak bunu yaparsınız ? Açıklayınız. (Bu soru ile öğrenciler hem önceki bilgileri ile bağlantı kuracak hem de yeni bir sorun ile karşılaştıkları için öğrencilerin derse dikkati çekilmiş olacak?)

01:06- Çevremizdeki kokuları algılamamızın önemi konusunda neler söyleyebilirsiniz? (Bu soru ile öğrencilerin; kendini ifade etme ve bilgisini yorumlama becerisi gelişmektedir)