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Science Teachers's and Science Teacher Candidates's View about Using Cartoon Movies in Science Teaching[1]

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ABSTRACT

The aim of this study is to determine the opinions of science teachers and science teacher candidates about using cartoon movies during science instruction. Phenomenology pattern which is a qualitative research method was used in this research. Research was conducted with 52 science teachers and 48 pre-service science teachers. Data were collected with an open-ended survey which is created by the researcher. Gained data were analyzed with the content analyze method. As a result of this research, science teachers and pre-service science teachers stated that both cartoon films and cartoon characters have a significant effect on children, help concretize the science subject and help permanent learning. It was also emphasized that it could create an enjoyable learning environment by attracting students' attention. Participants stated that using cartoon movies can be beneficial at the beginning of the lesson. In addition, the solar system and planets, systems, space, force and motion were presented as the most appropriate science topics in which cartoons can be used. The most given example cartoons are Tom and Jerry, Smurfs, Popeye, Jetsons, SpongeBob and Rafadan Crew. 87 of the 98 participants who participated in the study indicated that cartoons could be used during science teaching. On the other hand, some science teachers and pre-service science teachers indicated that the use of cartoon movies in science lesson can lead to distraction, loss of time and deviation from the purpose of the subject. Apart from this, the participants stated that they want to design educational-instructional, entertaining and remarkable cartoons.

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INTRODUCTION

Nowadays, children have been intertwined with technology. Therefore, it is not possible to think education without technology. Both it is necessary to take advantage of technology for an effective learning and a good education should be taken to benefit from technology. Societies have been influenced by changing and developing technology. Technological devices such as television, mobile phone, and computer have a task that to convey and disseminate information to everyone without being place and time (Kocadaş, 2004). Although many different technological devices are produced, television is still one of the most prevalence technological devices. Since it can appeal to more than one sense organ, it easily affects almost everyone, especially children. Television has an important place in children's understanding and recognition of the outside world. Therefore, it is important that using television should be beneficial for cognitive and social development of children (Büyükbaykal, 2007).

According to Turkish Statistical Institute (TUIK) 2013 data, 47.7% of boys and 51.4% of girls in the 6-10 age group watches television between 0-2 hours a day. Watching TV time of 11-15 age group children also shows similarity with other children (Bursa Eskişehir Bilecik Development Agency (BEBKA), 2018, s.24). This case shows that television is an important place in children's lives.

Cartoon movies are also one of the most watched TV programs. According to 2013 TUIK data, 95 % of children in the 6-10 age group prefers watching cartoon movies (BEBKA, 2018, s.23). Even though, children's preference of TV program changes as children get older, approximately 50% of 11-15 age group of children still prefer watching cartoon movies on TV (BEBKA, 2018, s.24). According to this result, although the rate of preference shows a decline as children get older, cartoon movies are still preferred by children at important rate.

Reasons of preference cartoon movies are that they have simple expression, stimulate imagination of children, easily identify with the events, give pleasure and events go beyond living environment (İnce, 1991, s.67). Although cartoon movies are produced for the aim of entertainment at the beginning, they have many usage area. They can use for advertisement, education, even propaganda (Can, 1995, s.61; Kaba, 1992, s.19). Characters of cartoon movies can also be used in industry of music, furniture, stationary and clothing (Türkmen, 2012).

Cartoon movies provide benefit to educational process. Cartoon movies contribute to both development of linguistic and cognitive skills of children and enlargement of children's perspectives about life. Besides, cartoon movies enable children to learn concepts at an early age. Visual and auditory expressions in cartoon movies help learning to become more effective and permanent (Yağlı, 2013). As in cartoon movies, characters of cartoon movies are effective in conveying message and acquiring behavioral skills (Aydın, 2018). All of these show that cartoon movies can be used in the educational field.

Science education contains both abstract and concrete concepts together. Technological opportunities contribute to the teaching of abstract and complex subjects that are difficult to teach (Kahyaoğlu, 2011). Cartoon movies can contribute to the teaching of science because both they are easily accessible and they are preferred by most of students. In addition, subjects of science education are related to daily lives. All these make it important to investigate the effectiveness of the use of cartoon movies that children watch fondly in science teaching. In both national and international studies, it has been revealed by semi-experimental studies that the use of cartoon movies in science education contributes to the academic success of students (Abdüsselam, 2013; Barak, Ashkar and Dori, 2011; Çelik, 2015). In addition, the study of Dalacosta, Paparrigopoulou-Kamariotaki and Pavlatou (2011) emphasize that cartoon films can be beneficial in order to teach scientific concepts. Apart from this, when the literature was examined, no study was found to determine the opinions of science teachers about the use of cartoon movies in science education. This case also increases the important of this research. When considered all these cases, the aim of this research is to determine the opinions of science teachers and science teacher

candidates about using cartoon movies in science education.

The problem of research

What are the views of science teachers and pre-service science teachers about the place of cartoon movies in science education?

The subproblems of research

1. What are the effects of cartoon movies on children according to science teachers and pre-service science teachers?

2. What are the advantages and disadvantages of using cartoon movies in science teaching according to science teachers and pre-service science teachers?

3. How would you design cartoon movies as science teachers and pre-service science teachers?

4. Which science subjects should be benefited from cartoon movies according to science teachers and pre-service science teachers?

5. In which part of science teaching should cartoon movies be used according to science teachers and pre-service science teachers?

6. What are the effects of cartoon movies' characters on children according to science teachers and pre-service science teachers?

7. Would science teachers and prospective teachers teach science using cartoon characters? Why?

8. Which cartoon movies characters and/or cartoon movies can be used in science teaching according to science teachers and pre-service science teachers?

METHOD

Research Design

Qualitative research method was used in this study in which the opinions of science teachers and teacher candidates were questioned about the use of cartoons in science education. In this study, phenomenology pattern was chosen from qualitative research methods. Phenomenology studies focus on phenomena that we are aware of but we do not have an in-depth and detailed idea of it (Yıldırım & Şimşek, 2018). When all these were examined, the phenomenology design was chosen from the qualitative research method in accordance with the problems and sub-problems of this research.

Research Sample/Study Group/Participants

In this study, purposive sampling method, which is one of the non-random sampling approaches, was used to conduct in-depth research for the purpose of the research (Büyüköztürk et al., 2018). 52 Science teachers and 46 pre-service science teachers participated to this study.

Research Instruments and Processes

Open ended questionnaire form which developed by researcher was used in this research. Open ended questions were formed as a result of literature review (Berber et al., 2019; Özeskici, 2014; Seçkin Kapucu, 2014). The questions of the questionnaire were examined by 1 professor who is the head of mathematics and science education department and 2 science teachers and necessary corrections were made. The open-ended questionnaire, which was originally prepared as 10 questions, was reshaped as 8 questions after expert opinions and corrections. Later, this questionnaire was sent to the participants as an e-mail. At the beginning of the questionnaire, brief information about the study was given to participants and thanked to participants.

Data Analysis

Content analysis method was used to analyze the data obtained from the open-ended questionnaire. The aim of content analysis is to reach the concepts and relationships that can explain the obtained data. In the content analysis, it is tried to reach the hidden truths in the data (Yıldırım & Şimşek, 2018, s. 242).

Codes were formed from the obtained data from open ended questionnaire. The codes were brought together and categories were formed. The interrelated categories were also combined under the themes created on the basis of the research questions. Codes, categories and themes are presented in tables with frequencies.

Information about Validity, Reliability and Ethic

In order to ensure internal validity in the study, the literature was scanned in detail before the open-ended questionnaire questions were created. In addition, it is aimed to increase the validity of this research by explaining the research method chosen in accordance with the purpose of the research, the data collection tool and the analysis process of the obtained data in detail.

The fact that the open-ended questionnaire is filled in personally by the science teachers and pre-service science teachers, each of the questionnaires filled by the participants is numbered and kept separately, more than one person participates in the coding while making the data analysis, the data analysis which is carried out in accordance with the research problem, and the quotations from the participants' statements are included in the findings contribute to the reliability of the research. The fact that the coding made by people who are unaware of each other is close to each other contributes to the reliability between the evaluators. In order to have similar codes to be reliable, the compliance percentage should be 70% or higher (Şencan, 2005). The percentage of compliance of the coding created in this study was calculated with the formula specified by Miles and Huberman (1994). The compliance percentage of the study was calculated as 92.77%. This indicated that the study is reliable. Ethics committee approval is not required for this study because it was made in 2019.

FINDINGS / RESULTS

The views of science teachers and prospective science teachers about the use of cartoon movies and characters in lessons were analyzed and presented in tables. While expressing an opinion; teachers were coded as “T1, T2,…” and pre-service teachers were coded as “S1,S2,…”.

1. Findings about the Opinions of Science Teachers and Teacher Candidates on the Effect of Using Cartoon Movies in Science Teaching on Children

During science teaching, the opinions of teachers and prospective teachers about the effect of using cartoons on children are obtained, and the data are analyzed and the results are presented in Table 1.

Table 1. *Opinions of teachers and pre-service teachers on the effect of cartoon movies on science teaching*

Theme	Category	Code	Frequency(Teacher)	Frequency(Preservice teacher)
The effect of cartoon in science teaching	Effect on children	Age related	2	1
		Positive	11	9
		Negative	2	-
		Increase imagination	4	7
		Interesting	4	1
		Intriguing	8	7
		Visual and sensory memory	3	-
		Success	-	1
		Thinking skill	1	4
		Self-confidence	-	1
		Influence	-	2
		Readiness level	1	1
		Prejudice	1	-
		Appropriate for the level	5	3
		Perspective	-	2
		Questioning	-	1
		Cognitive skill	-	1
		Psychomotor skill	-	1

In the Table 1., the opinions of science teachers and teacher candidates are presented by creating 18 codes under the category of "Effect on children". The most reported opinions under the category of the “Effect on children” are; positive ($f_{teacher}$=11, $f_{teacher\ candidate}$=9), intriguing ($f_{teacher}$=8, $f_{teacher\ candidate}$=7), increase imagination ($f_{teacher}$=4, $f_{teacher\ candidate}$=7), appropriate for the level ($f_{teacher}$=5, $f_{teacher\ candidate}$=3), interesting ($f_{teacher}$=4, $f_{teacher\ candidate}$=1) and thinking skill ($f_{teacher}$=1, $f_{teacher\ candidate}$=4).

Sample statements of science teachers and prospective teachers about the effect of cartoons on children are presented below:

T11: The use of cartoons in science teaching has intriguing and interesting effects on students.

T15: I think that cartoons will entertain children and make learning effective while having fun, but I think that this will not be effective for 8th grade students, and children who feel that they have grown up at that age will act prejudiced.

S11: It has lots of positive effect. Because science lesson is related to daily life and I think it will be very useful in terms of attracting students' attention to the lesson.

S24: It enables children to think more creatively and critically.

S38: ……. There are positive effects on learning concepts more quickly, developing imagination and creative thinking.

2. Findings about the Opinions of Science Teachers and Teacher Candidates about Advantages and Disadvantages of Using Cartoon Movies in Science Teaching

The opinions of teachers and prospective teachers about the advantages and disadvantages of using cartoons during science teaching are taken, and the data are analyzed and the results are shown in Table 2.

Table 2. *Opinions of teachers and pre-service teachers about advantages and disadvantages of cartoon movies on science teaching*

Theme	Category	Code	Frequency(Teacher)	Frequency(Preservice teacher)
Cartoon movies on science teaching	Advantages	Attract attention	26	16
		Concretizing the topic	18	7
		Permanent learning	25	20
		Easy learning	16	5
		Break down the prejudices	1	-
		Interesting	18	14
		Learning fun	21	20
		Related to daily life	4	4
		Motivation	5	8
		Positive attitude	2	6
		Misconception remover	1	1
		Ease of use	1	-
		Visuality	3	-
		Reinforcing the topic	2	-
		Technological	1	-
		Helping the topic	10	9
		Including science process skills	3	5
		Active participation	-	3
		Economic	1	2
		Different method	-	3
		Focusing	2	2
		Actuality	1	-
		Getting feedback	1	-
		Suitable for individual differences	-	1

Table 2. (Continue)

Theme	Category	Code	Frequency(Teacher)	Frequency(Preservice teacher)
Cartoon movies on science teaching	Disadvantages	Unsuitable for the subject	4	3
		Distractibility	7	7
		Boring	3	2
		Disregard	3	1
		Deviation from the target	11	17
		Laziness	1	-
		Waste of time	8	3
		Confusion of perception	5	3
		Misconception	7	5
		Technological shortcomings	1	1
		Resource shortage	1	-
		Addiction	7	3
		Noise(Classroom management)	1	2
		Health problem	1	1
		Focusing problem	1	4
		Ordinariness	1	-
		Inappropriate for every age	2	5
		Loss of interest	-	1
		Behavioral problem	-	1
		Miscommunication	-	1
		Negative character	-	2

When examined the Table 2, it is seen that the ideas about the benefits and harms of using cartoon films in science teaching are expressed under the headings of "advantages" and "disadvantages". The codes with the most stated in the "Advantage" category; permanent learning ($f_{teacher}$=25, $f_{teacher\ candidate}$=20), attract attention ($f_{teacher}$=26, $f_{teacher\ candidate}$=16), learning fun ($f_{teacher}$=21, $f_{teacher\ candidate}$=20), interesting ($f_{teacher}$=18, $f_{teacher\ candidate}$=14), concretizing the topic ($f_{teacher}$=18, $f_{teacher\ candidate}$=7), easy learning ($f_{teacher}$=16, $f_{teacher\ candidate}$=5) and helping the topic ($f_{teacher}$=10, $f_{teacher\ candidate}$=9). Under the "Disadvantage" category, deviation from the target ($f_{teacher}$=11, $f_{teacher\ candidate}$=17), distractibility ($f_{teacher}$=7, $f_{teacher\ candidate}$=7), misconception ($f_{teacher}$=7, $f_{teacher\ candidate}$=5), waste of time ($f_{teacher}$=8, $f_{teacher\ candidate}$=3) and addiction ($f_{teacher}$=7, $f_{teacher\ candidate}$=3) are the codes that are signified frequently.

Sample statements of science teachers and prospective teachers about the advantages and disadvantages of cartoons during science teaching are presented below:

T5: Advantages: It draws attention to the subject. It provides a better understanding of the subject.

T12: Disadvantages; carelessly prepared cartoons can lead to misconceptions

T15: Moving away from the main topic, confusing the school with the game, and thinking that the information is not real may have negative aspects.

T19: Advantages include motivation, learning in a fun environment, and permanent learning.

T25: Advantages; Children learn by having fun. Thanks to the cartoon character which they love, they watch without getting bored and they learn without realizing it.

T32: Disadvantages, it can cause distraction on children after a certain period of time.

S20: It helps make the lesson fun. It is effective in permanent learning.

S41: As an advantage; it provides permanent learning, it is more suitable for individual differences since there are different techniques and methods, and it motivates students to the lesson.

3. Findings about the Opinions of Science Teachers and Teacher Candidates on the Elements to be considered in Designing Cartoon Movies

The opinions of the science teachers and pre-service teachers about how they want to design cartoon movies as an educator are taken and the data are analyzed and the results are presented in Table 3.

Table 3. *Views of teachers and teacher candidates on the elements to be considered while designing cartoon movies as educators*

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
Elements to consider in cartoon movie design as an educator	Effect on children	Age appropriate	5	1
		Remarkable	5	8
		Entertaining	6	11
		Dream world expander	1	-
		Intriguing	4	1
		Positive effect	1	-
		Suitable for student level	-	1
		Awareness raising	-	1
	Science education	Relevant to the topic	8	11
		Concretizing the topic	2	-
		Misconception-free	2	-
		Containing scientific knowledge	1	3
		Containing experiment	6	4
		Educational-instructive	9	10
		Related to daily life	4	2
		Containing activity	1	-
		Excogitative	-	2
		Containing scientific process skills	-	9
		Containing engineering skills	-	2
		Increase the attitude towards science	-	1
		Developing creativity skills	-	5
	Appropriate science topics	Space	1	-
		Sexual reproduction in plants	1	-
		Scientists	2	1
		Vitamins	1	-
		Our body	2	-
		Circulatory system(Systems)	1	1
		Living things	3	1
		Photosynthesis	1	-
		Pressure	1	-
		Meiosis-Mitosis division	1	-
		Lunar phase	1	-
		Environment	1	3
		Planet	1	2
		Energy sources	-	1
		Nutrition	-	1

Table3. (Continue)

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
Elements to consider in cartoon movie design as an educator	Cartoon film	Quality of image	1	-
		Containing game	3	-
		Like a documentary	1	-
		Containing song	1	-
		Gripping	1	-
		Comic	1	-
		Exciting	1	-
		With a story	4	2
		Animated	5	3
		Clear and precise	1	4
		Adventurous	2	-
		Technological	-	1
		Fantastic	-	1
		Reflecting the truth	-	1
		Visual	-	2
		Mysterious	1	-
		Ethical	1	2
	Characters	Popular	3	1
		Using scientific process skills	2	-
		Conforming to social values	2	-
		Interesting	2	1
		Up to date	1	-
		Suitable for student level	-	1

According to Table 3, the opinions of science teachers and teacher candidates about the elements to be considered in cartoon film design from the perspective of the educator are united under 5 categories. Under the category of "Effect on children"; entertaining ($f_{teacher}$=6, $f_{teacher\ candidate}$=11) and remarkable ($f_{teacher}$=5, $f_{teacher\ candidate}$=8) codes are the codes with the highest number of comments. The codes with the highest number of opinions in the "Science teaching" category respectively; relevant to the topic ($f_{teacher}$=8, $f_{teacher\ candidate}$=11), educational-instructive ($f_{teacher}$=9, $f_{teacher\ candidate}$=10), containing experiment ($f_{teacher}$=6, $f_{teacher\ candidate}$=4) and containing scientific process skills ($f_{teacher\ candidate}$=9). Under the category of "Appropriate science topics"; environment ($f_{teacher}$=1, $f_{teacher\ candidate}$=3), living things ($f_{teacher}$=3, $f_{teacher\ candidate}$=1), planet ($f_{teacher}$=1, $f_{teacher\ candidate}$=2), scientists ($f_{teacher}$=2, $f_{teacher\ candidate}$=1) and our body ($f_{teacher}$=2) are the most preferred codes. In the "Cartoon film" category; animated ($f_{teacher}$=5, $f_{teacher\ candidate}$=3), with a story ($f_{teacher}$=4, $f_{teacher\ candidate}$=2), clear and precise ($f_{teacher}$=1, $f_{teacher\ candidate}$=4), containing game ($f_{teacher}$=3) and ethical ($f_{teacher}$=1, $f_{teacher\ candidate}$=2) are the most codes. In the "Characters", popular ($f_{teacher}$=3, $f_{teacher\ candidate}$=1) and interesting ($f_{teacher}$=2, $f_{teacher\ candidate}$=1) are the most commented codes.

Sample statements of science teachers and prospective teachers about the items to be considered while designing cartoon films are presented below:

T12: I want to design cartoon films that will not lead students to misconceptions, generally related to daily life.

T25: I would design a cartoon that is intriguing and that the child can learn cognitively as a result…..

T39: Appropriate to the topics

T43: For example, I could show beneficial vitamins or elements with better visuals, and harmful vitamins with bad characters.

S2: I used to make cartoons that appealed to the creativity of the students, directed them to research and questioning, and also developed their engineering practices.

S18: I would create cartoon characters suitable for the student's level for science teaching…..

S21: It would be fantastic cartoons absolutely. Extraordinary, irrational situations and events have always attracted the attention of humanity.

S43: I used to design interesting and catchy short cartoons that would explain the science units visually.

4. Findings about the Opinions of Science Teachers and Teacher Candidates on Science Topics that can be told with Cartoon Movies

The opinions of teachers and pre-service teachers about which science subjects can explain with cartoon movies are taken and the data are analyzed and the results are presented in Table 4.

Table 4. *Opinions of teachers and teacher candidates on science subjects that can be told with cartoon movies*

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
Science topics that can be explained with cartoon	Living things and Life	Living Things	8	4
		DNA and Genetic Code	5	-
		Virus and Bacteria	2	-
		Meiosis and Mitosis	1	-
		The Plant	2	2
		The Cell	3	-
		Systems	12	13
		Human Body	4	-
		Nutrition	4	7
		Biodiversity	1	2
		Photosynthesis	-	1
		Biotechnology	1	-
		Vitamin	1	1
		Classification	2	1
		Cell Division	1	1
		Growth and Development	-	1
		Respiratory	-	1
	Physical Events	Velocity/Speed	7	4
		Simple Machine	5	2
		Pressure	2	2
		Mass and Weight	1	-
		Mirrors	1	1
		Force	7	6
		Work, Power and Energy	3	3
		Electricity	2	1
		Buoyancy	-	3
		Expansion	-	1
		The Magnet	-	1
		The Sound	1	1
		The Light	1	-
	The Matter and its Nature	Density	2	-
		The Structure of Matter	4	-
		Matter and Change	3	3
		Heat and Temperatures	2	-
		Periodic Table	2	-
		Acid-Base	1	-
		Matter and its Properties	2	1
	The Earth and The Universe	Space	9	4
		Climate	3	-
		Solar System and Planets	15	8
		Natural Events	1	1
		Environment	1	4
		Phase of the Moon	1	3
		Seasons	2	1
		Solar and Lunar Eclipse	1	-
	General	All	9	8
		Abstract topic	14	2
		Topics with experiment	3	3
		Observable topic	1	-
		Invisible things	3	-
		Socio-scientific issues	1	1
		Scientists	2	-

In the Table 4, the opinions of teachers and pre-service teachers about science subjects in which cartoon movies can be used are stated in 5 categories. Under the category of "Living things and Life", the most frequently mentioned science topics are systems ($f_{teacher}$=12, $f_{teacher\ candidate}$=13), living things ($f_{teacher}$=8, $f_{teacher\ candidate}$=4) and nutrition ($f_{teacher}$=4, $f_{teacher\ candidate}$=7). In the category of "Physical Events", force ($f_{teacher}$=7, $f_{teacher\ candidate}$=6), velocity/speed ($f_{teacher}$=7, $f_{teacher\ candidate}$=4) and work, power and energy ($f_{teacher}$=3, fteacher candidate=3) are the most preferable topics. Under the title of "Matter and its Nature", matter and change (fteacher=3, fteacher candidate=3) and the structure of matter ($f_{teacher}$=3) are the most exemplary subjects. Under the "The Earth and The Universe" category, solar system and planets ($f_{teacher}$=15, $f_{teacher\ candidate}$=8) and space ($f_{teacher}$=9, $f_{teacher\ candidate}$=4) are the most preferable topic. In the "General" category, the most commented codes are abstract topics ($f_{teacher}$=14, $f_{teacher\ candidate}$=3) and all ($f_{teacher}$=9, $f_{teacher\ candidate}$=8).

Sample expressions of examples given by science teachers and teacher candidates about science topics that can be explained with the help of cartoon movies:

T4: In the unit of living things, we can benefit from cartoons in order to understand the living things more and its characteristics that children cannot encounter in daily life.

T14: It will be more advantageous to use it on non-formula subjects that can be learned by observing more.

T21: Films with daily events such as planets, solar and lunar eclipses can be advantageous. Because events that we have seen before and maybe we are not aware of them. In this way, we can be aware of them.

T41: I think it will be more beneficial in terms of atoms and systems because it will be beneficial to watch them multidimensional.

S12: For example, subjects such as the digestive and excretory system seem abstract to students and there are studies in the literature that they have difficulty in understanding. Cartoons can be used for permanent learning in these subjects.

S43: ……. Force and Motion, Sound and its Properties, Energy, Simple Machines

5. Findings about the Opinions of Science Teachers and Teacher Candidates about which Stage of the Science Lesson can be used cartoon movies

The opinions of science teachers and pre-service teachers about which part of the science lesson to be used with cartoon movies are examined, and these are divided into themes, categories and codes and these are presented in Table 5.

Table5. *Opinions of teachers and teacher candidates on which stages of the lessons cartoon movies can be used*

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
Stages in which cartoon movies are used in teaching	Before teaching the subject	Introduction	24	24
		Draw attention	18	25
		Inform the target	1	-
		Curiosity	2	4
		Readiness	2	1
		Motivation	-	5
		Detection of misconception	2	-
	While teaching the subject	Explanation	4	1
		Practice	1	-
		Exploring	8	5
		Concept teaching	3	3
	After teaching the subject	Elaboration	14	7
		Reinforcement	8	7
		Summarize	3	1
		Associating with daily life	2	4
		Evaluation	1	-
		After topic	3	3
		Sampling	-	1
		At every stage	5	1

According to Table 5, the opinions of science teachers and teacher candidates about the stages in which cartoon movies are used in education are grouped under 3 categories. Codes that are frequently commented on under the category of "Before teaching the subject"; introduction ($f_{teacher}$=24, $f_{teacher\ candidate}$=24), draw attention ($f_{teacher}$=18, $f_{teacher\ candidate}$=25), curiosity ($f_{teacher}$=2, $f_{teacher\ candidate}$=4) and motivation ($f_{teacher\ candidate}$=5). Under the "While teaching the subject" category, codes with the highest number of comments are exploring ($f_{teacher}$=8, $f_{teacher\ candidate}$=5) and concept teaching ($f_{teacher}$=3, $f_{teacher\ candidate}$=3). In the "After teaching the subject" category; elaboration ($f_{teacher}$=14, $f_{teacher\ candidate}$=7) and reinforcement ($f_{teacher}$=8, $f_{teacher\ candidate}$=7) are the most preferable codes. 5 science teachers and 1 pre-service teacher state that cartoon movies can be used at every stage.

Sample expressions from the views of science teachers and pre-service teachers about the stages at which cartoon films can be used in the teaching process:

T28: I would use it in the elaboration part. After teaching the subject, I would make the children learn better by having fun.

T40: After the theoretical knowledge, it can be used for explanation and detailedness.

T43: I use it at all stages as long as I can. Because I think it is more effective training.

T45:…… It can be applied in the introduction to detect misconceptions about the subject.

S18: I can use cartoons at every stage of the teaching process. It varies depending on the nature of the subject.

S28: I use it at the introductory phase to draw attention to the subject and arouse curiosity.

S35: I use it to make the subject more permanent when we process the subject and move on to the repetition stage.

S40:……. cartoon film seems like a good tool for a student to learn the subject during the exploration phase……..

6. Findings about the Opinions of Science Teachers and Pre-service Teachers on the Effect of Cartoon Characters on Science Teaching

The themes, categories and codes obtained from the analysis of the opinions of the science teachers and pre-service teachers about the effect of cartoon characters on science teaching are shown in Table 6.

Table 6. *Opinions of teachers and prospective teachers about the effect of cartoon characters on science teaching*

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
The Effect of Cartoon Characters in Science Teaching	Effect on children	Imagination	4	1
		Self-expression	1	-
		Identification	18	13
		Positive effect	10	9
		Negative effect	10	5
		Being a role model	16	19
		Depends on the character	1	-
		Perception confusion	1	-
		Age	6	1
		Character development	1	1
		Change of perspectives	-	2
		Permanent effect	1	3
		Enjoyable	7	1
		Motor development	-	1
		Mental development	-	2
		Raise consciousness	-	1
		Digital generation	1	-

Table 6. (Continuous)

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
The Effect of Cartoon Characters in Science Teaching	Effect on the lesson	Fun learning	5	7
		Attract attention	5	7
		Helping to learn	6	5
		Permanent learning	10	7
		Interesting	11	5
		Visuality	1	-
		Positive attitude	2	2
		Concretization	2	-
		Curiosity	1	-
		Reinforcement	1	-

Looking at Table 6, opinions about the effect of cartoon characters in science teaching are grouped under two categories. In the category of "Effect on children", the opinions of teachers and prospective teachers are listed with the codes respectively; being a role model ($f_{teacher}$=16, $f_{teacher\ candidate}$=19), identification ($f_{teacher}$=18, $f_{teacher\ candidate}$=13), positive effect ($f_{teacher}$=10, $f_{teacher\ candidate}$=9), negative effect ($f_{teacher}$=10, $f_{teacher\ candidate}$=5), enjoyable ($f_{teacher}$=7, $f_{teacher\ candidate}$=1), age ($f_{teacher}$=6, $f_{teacher\ candidate}$=1). Under the "Effect on the Lesson" category, codes with the highest number of comments are permanent learning ($f_{teacher}$=10, $f_{teacher\ candidate}$=7), interesting ($f_{teacher}$=11, $f_{teacher\ candidate}$=5), fun learning ($f_{teacher}$=5, $f_{teacher\ candidate}$=7), attract attention ($f_{teacher}$=5, $f_{teacher\ candidate}$=7) and helping to learn ($f_{teacher}$=6, $f_{teacher\ candidate}$=5).

Sample expressions taken from the opinions of science teachers and teacher candidates regarding the effects of cartoon characters on children and the lesson:

T2:…… It is very good in terms of making the subject easy to understand.

T8:…… It can cause children to think that everything is simple, easy or doable.

T30: Children can learn in a fun way without getting bored.

T50: I can use it to attract students' attention to the lesson.

S9: They can take her as an example since they love the character so much.

S27:…. For example, children may think that they can fly by taking the example of Superman, and this affects them badly……

S37: It enables children to learn permanently.

S41: First of all, children can see their favorite cartoon characters as idols and try to do what they do, so cartoon characters should be chosen carefully and their content should be suitable for children.

7. Findings about the Ideas of Science Teachers and Teacher Candidates on the Science Teaching with Cartoon Characters

The views of science teachers and prospective teachers about the use of cartoon characters in science lessons are presented in Table 7.

Table 7. *Situation of teaching science lesson with using cartoon characters of science teachers and pre-service teachers*

Theme	Category	Frequency (Teacher)	Frequency (Preservice teacher)	Reason for "No"
Situation of Teaching with Cartoon Characters	YES	44	37	
	NO	5	5	Waste of time, Density of Curriculum, Distractibility, Lack of appropriate cartoon movies and characters
	SOMETIMES	3	3	
	INDECISIVE	-	1	

When Table 7 is examined, most of the science teachers (f=44) and teacher candidates (f=37) expressed their opinions under the category of "Yes". Under the category of "No", 5 science teachers and 5 prospective science teachers offered their ideas. While 3 teachers and 3 pre-service teachers expressed their opinions on the "Sometimes" category, 1 pre-service teacher expressed an opinion under the "Indecisive" category.

Sample expressions of science teachers and teacher candidates about the using cartoon characters:

T4: No. It could be a waste of time because of the curriculum density.

T16: Yes. It's a great way to get the student's attention.

T29: Sometimes. In order to teach the subject by attracting attention.

T52: Yes. When it combined with the case study method, it stimulates imagination and multi-faceted thinking.

S3: I wouldn't do it because it may cause inattention to the lesson in children.

S15: Yes, I do. In order to develop their imagination and observation skills.

S17: I'm undecided.

S32: It is difficult to find a cartoon character that appeals to all students, so I do not think I will use it.

8. Findings about the Examples Given by Science Teachers and Teacher Candidates about Cartoons and/or Cartoon Characters That Can Be Used in Science Lesson

Sample cartoon films and characters given by science teachers and prospective teachers about cartoons and/or cartoon characters that can be used in science lessons are given in Table 8.

Table 8. *Examples of cartoons and/or cartoon characters that can be used in science teaching*

		Frequency (Teacher)	Frequency (Preservice teacher)
Example Cartoon Movies/ Cartoon Characters	Vikings	1	-
	Batman	1	-
	Jetsons	4	-
	Spiderman	1	1
	Sponge Bob	4	2
	Pepe	3	1
	The wise uncle in the brain	1	-
	Inspector Gadget	1	-
	Popeye	4	4
	Smurfs	6	1
	Elif's World	1	1
	Rafadan Crew	4	-
	Cars	1	1
	Road Runner	2	1
	Kakuli	1	-
	Caliuo	1	-
	Teletubbies	1	1
	Bugs Bunny	2	3
	Mickey Mouse	2	-
	Heidi	3	-
	Tarzan	1	-
	Sonic	1	-
	Scientists	3	-
	Pac man	1	-
	Tom and Jerry	3	7
	Transformers	1	-
	King Shakir	1	-
	Ben 10	-	1
	Pijamasks	-	1
	Masha and the Bear	-	1
	RedKit	-	1
	Mint and Lemon	-	1
	Iron Man	-	1
	Tweety	1	1
	Beyblade	-	1
	Monkey D.Luffy	-	1
	Garfield	-	1
	Keloğlan	-	1
	Scooby do	-	1
	Fish Nemo	-	2
	Bee Maya	-	2
	Rick and Morty	-	1
	Aqua man	-	1
	Superman	-	1
	Yogi Bear	-	1
	The Cat in the Hat	-	1
	Phineas	-	1
	Time Travelling	-	1
	Once upon a time	1	-

When Table 8 is examined, the cartoon films and its characters that teachers mostly said are Smurfs (f=6), Jetsons (f=4), SpongeBob (f=4), Popeye (f=4), Rafadan Crew (f=4), Heide (f=3), Scientists (f=3), Pepe (f=3), Tom and Jerry (f=3). On the other hand, the pre-service teachers mostly state the cartoon movies such as Tom and Jerry (f=7), Popeye (f=4), Bugs Bunny (f=3) and their characters, respectively.

Opinions of teachers and pre-service teachers about Sample Cartoons/ Cartoon Characters:

T10:…… I could have explained the issue of healthy eating with the Popeye character. I can make the importance of eating vegetables more effective by using a character.

T25: To give an example, while Kamil is about to hit the ball in one of the cartoons Rafadan Crew, the motionless ball moves due to the wind and Kamil cannot hit the ball properly and washes Rüstem brother's Meatball car. Here, I would associate it with the lesson, based on the fact that the wind exerts a force on the ball and Kamil does not calculate it.

T35: I would explain the subject of the Earth and space with the Jetsons.

S13: I can explain the relationship between pressure and depth with the SpongeBob.

S27: I would explain the 5 sense organs with the Pepe cartoon film.

S41: I can use the Bugs Bunny in the healthy diet thanks to the eating carrots. Popeye can be in the topic of power and movement.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

Views of 52 science teachers and 46 pre-service science teachers were received about using cartoon movies in science education. By comparing obtained data with studies in literature, similarities and differences are tried to be revealed in this research.

Science teachers and pre-service teachers mentioned that cartoon movies have positive effects on children such as being intriguing, contributing to their imagination, increasing their interest, and expanding their thinking skills mostly. On the other hand, it has been stated that children may be prejudiced against cartoon movies as they get older, and that they may be influenced excessively by cartoon movies and harm themselves. The result of this study is compatible with the results of Eskandiri's (2007) study. In Eskandiri's study; cartoon movies can have educational, entertaining and imaginative effects in terms of positive. On the other hand, it is stated that it could encourage violence and inhibit the reading books and the lessons negatively.

Science teachers and pre-service teachers stated that the advantages of using cartoon movies during science teaching outweigh the disadvantages. The advantages of cartoon movies are mostly emphasized such as attracting attention, concretizing the subject, providing permanent learning, helping learning, contributing to a fun learning environment, facilitating learning. Disadvantages of the use of cartoon movies in science lessons are mentioned such as distraction, causing misconceptions, the subject to move away from its purpose, and waste of time.

As in this study, in Berber, Anılan, Odabaş and Alkan (2019) study, 16 pre-service science teachers emphasized on features about using cartoon movies in science education. These are interesting, beneficial for physical personal development, making education fun, developing imagination, and providing permanent learning. In another study conducted by Aslan (2020) with science of life teachers, the science of life teachers who expressed their opinions state that cartoon movies concrete the subject, visualize it, help knowledge transfer and contribute to permanent learning. Religious culture teachers also reported that the use of cartoons in lessons would be beneficial by increasing the quality of in-class activities (Sancak, 2018). In Sajana (2018) study; it stated that cartoon movies contribute to English speaking and writing skills and provide a fun learning environment. Apart from these studies, in the study conducted

by Seçkin Kapucu (2014), science teachers reported that the use of visual media in the lesson may cause some negative consequences such as inability to concentrate, unsuitable for the level of the student, not setting the time and being irrelevant to the subject. The opinions are similar to the disadvantages stated regarding the use of cartoon movies in the lesson.

Science teachers and teacher candidates participated in this research stated that cartoon films should be designed as educational-instructive, attractive, entertaining, suitable for science subjects, containing experiments, scientific process skills, clear and precise, containing plenty of animation and fun characters. These results support the study of Yağlı. The research of Yağlı (2013) stated that positive cartoon movies can contribute to the development and imagination of children. In addition, in the study of Özeskici (2014), visual art teachers and pre-service teachers stated that cartoon movies can cause negative effects such as leading to violence, causing laziness, causing confusion, causing addiction and creating addiction. These results show that cartoon films should be designed carefully.

Most of the science teachers and pre-service teachers who participated in this study emphasized that cartoon movies can be used during the teaching of science. Especially, the solar system and planets, systems, space, living things, force, nutrition and velocity/speed are the prominent science subjects. In the study of Berber, Anılan, Odabaş and Alkan (2019), it indicated the human body, force and motion, space, living things, the sun and nature as examples in the study like this research. In addition, it was emphasized that almost all science subjects can be instructed with cartoon films.

Most of the science teachers and pre-service science teachers stated that they can benefit from cartoon films for introduction to topic and drawing attention before starting the subject in science lesson. During the science lesson, it was emphasized by the participants that cartoon films can be used to discover, teach, explain the concepts and make applications. At the end of the topic; it has been stated that cartoon films can be used to elaborate the subject, to reinforce the subject, to summarize the subject, to establish a relationship between the subject and daily life, to evaluate the subject, and to give examples about the subject. As in this study, as a result of Aslan's (2020) study, teachers emphasized that cartoon movies can be used at the beginning, development, end and every stage of life studies lessons. In addition, Dalacosta, Paparrigopoulo-Kamariotaki and Pavlatou (2011) expressed in their study that cartoon films can be used as an assessment tool in science teaching.

Science teachers and pre-service teachers who participated in this study explained that children identify with cartoon characters easily and take them as role models. They also emphasized that teaching with cartoon characters is interesting, helps permanent learning, attracts attention and contributes to a fun learning environment. As in this research, Oruç, Tecim, and Özyürek's (2011) research also concluded that children take the positive features of cartoon characters as role models. In addition, another study concluded that popular cartoon characters are effective in conveying messages to children and internalizing behavior (Aydın, 2018).

When the data of this study is examined; 47 science teachers and 40 pre-service science teachers stated that they can teach with cartoon characters. 5 science teachers and 5 science teacher candidates stated that they would not use cartoon characters in science lessons because of the fact that cartoon characters can cause a waste of time, cannot finding suitable cartoons and characters, cause distraction, and worry about educating the curriculum. One pre-service science teacher also stated that s/he was undecided on this issue. As in this study, in the study conducted by Erdem (2019), 43 of 45 teachers said that they can use cartoon films while teaching Turkish to foreigners. Contrary to this study, more than half of the life studies teachers participating in Aslan's (2020) study stated that they do not use cartoon movies in the lesson. This situation explains that the use of cartoon films/characters in teaching may vary according to the course.

When the data of this study is examined, it was stated by the participants that many different cartoon films and/or cartoon characters could be used in science teaching. The most given example of cartoon

movies and characters are Tom and Jerry, Smurfs, Popeye, Jetsons, SpongeBob and Rafadan Crew. According to these results, it strikes that many different cartoon movies and cartoon characters can help to teach science concepts. The fact that so many cartoon movies and their characters are given as examples is an indication that cartoon movies can be used in science teaching easily.

Recommendations

- Opinions of secondary school students can be taken about the use of cartoons in science teaching.
- A scale can be developed about the use of cartoon films in science education.
- Preschool and primary school teachers' opinions can be obtained on the use of cartoon movies in the teaching of science subjects in their curriculum
- By bringing together cartoon film producers and science teachers, cartoon films that are suitable for science subjects and will not lead to misconceptions can be designed.
- A study can be made about whether cartoon movies are used in science lessons abroad.
- The opinions of the academicians in the education faculties of universities can be obtained about the use of cartoon films in science teaching.
- The effect of the using of cartoon movies on other courses can be investigated.
- Cartoon movies can be determined by science teachers according to the science subjects and grade levels.

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