Analysis of Science Images Presence in Cartoons (A Turkish TV Channel Case)*

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Abstract: Knowledge is an essential part of the continuity of humanity. Access to science is through knowledge and vice versa. Children are mostly preoccupied with television, mainly with children's programs on television channels especially cartoons. Cartoons are produced in order to entertain children and to contribute to their development and maturation. Since access to knowledge is through science, it is important that cartoons contain scientific images. Through the presentation and interaction with science images, cartoons arouse children's interest in science and contribute to their devotion to science. The aim of the present study is to determine if science images are included in cartoons and to what extent. The research is conducted in line with qualitative research method according to the case model. Whereas the population of the study is the cartoons broadcasted in the Turkish mass media, while determining the sampling method, purposive sampling has been preferred and thus currently broadcasted cartoons at TRT Cocuk (Turkish Radio and Television Children) channel, providing access to various cartoons from the same source, selected. Relevant data has been collected using " Form for Analyzing Scientific Image Presence in Cartoons" developed and applied by the researcher. The study has determined that the cartoons broadcasted include science images according to their thematic features.

Keywords: *Cartoon, science, image, science images, TRT Cocuk channel, children.*

Introduction

Knowledge and technology will always be present in the lives of people. People are in need of knowledge and thus technology to protect their lives against threats from nature, and the social and physical environment. Knowledge is an important factor in the continuity of humanity. Knowledge and technology are acquired through science. Science is sometimes knowledge, sometimes technology, sometimes nature, sometimes vital skills, sometimes and human beings alone. It is through science that daily tasks can be accomplished, future plans realized, projects, applications, technologies are designed and produced.

According to Turkish Language Institution (Turk Dil Kurumu) (n.d.) dictionary, science can be defined as regular knowledge choosing a part of the universe or events as a subject, trying to extract results from experimental methods and realities as well as the process of acquiring knowledge and methodical research.

Science was described as skills related to knowledge, cognition, expertise, and intelligence in the Latin world of 12th century; as information which was known and reached by studying in the mid-14th century; as certainty, information assurance in ancient French science; as a particular branch of knowledge or learning, a skill, crafts, trade at the end of the 14th century; in the modern sense since 1725 as to know, distinguishing one thing from another whole of suggestion, collection of information which obtained by systematic observation, experimentation and reasoning on a subject; as a philosophy in 17th-18th century; as non-art works after the 1670s. Online Etymology Dictionary (n.d.). According to Gould, science proceeds with hunch and vision. Culture and social activities affect what and how is seen. Creative theories are often creative visions imposed on facts and culture is the source of the imagination which is used here. (Gould as cited in Online Etymology Dictionary, n.d.).

Science is also explained as follows:

1. To reach new results and information by interpreting the current situations within their own processes

2. The skill of using knowledge in daily life

3. A thought system

4. The ability of the human to use critical and creative thinking skills (Yesiloglu et al., 2010)

5. All knowledge is a whole (Seven, 2004)

6. An effort to reach reality

7. A collection of systematic information that leads to theories

8. A constantly changing and evolving activity (Terzi, 2005).

Moreover, science has a mental and objective aspect. Science has dimensions including value judgment, creative elements, and emotions (Yildirim & Mahsereci, 1997).

The prediction of the continuous improvement of technology and science, children are encouraged to live under the influence of science in order to adapt to society and to the time they live in. As of today, children who are currently at the preschool and elementary school-age will take an active role in the development of society in the 21st century.

It is the expectation of societies from individuals to behave according to the requirements of time, to adapt to changing situations, and to continue in the natural flow of life. The rapid advancement in technology and knowledge and the pandemic process that the world is currently facing shows that there is always the need for more knowledge and technology.

Science is based on scientific research conducted in academic, government, research-related institutions, and companies. The applicability of research has led to the emergence of science policies that place emphasis on the development of commercial products, health care, environmental protection, and the development of weapons and equipment necessary for the defense of countries (Science, 2020).

When we look at it from a universal and present perspective, science is classified under three headings: Formal, Natural, and Social Sciences. Table 1 contains the classification of science. The sciences are basically mentioned and also their application areas are placed. It is a collection of abstract information such as formal science, mathematics, logic, and statistics. Natural sciences explain the structure and vital features of living things, also the structure of inanimate beings and the laws they follow. On the other hand, social sciences include the issues that arise from human behavior and form societies (Gauch, 2003).

Table 1. Branches of science

Science			
	Formal science	**Empirical sciences**	
		Natural science	**Social science**
Basic	Logic, mathematics, statistics	Physics, chemistry, biology, earth science, space science	Anthropology, economics, political science, sociology, human geography, psychology
Applied	Computer science	Engineering, agricultural science, medicine, materials science	Business administration, public policy, marketing, law, pedagogy, international development

According to NRC (1996), a science standard set for students was organized by the National Science Education Standards (NSES). There are eight science standards, which are listed as follows:

1. Unifying concepts and processes in science.
2. Science as inquiry.
3. Physical science.
4. Life science.
5. Earth and space science.
6. Science and technology.
7. Science in personal and social perspectives.
8. History and nature of science.

Science is a collection of producing information. Thus, the scientific process should be used for producing information. Scientific processes include many skills such as observation, classification, estimation, inference, experimenting, and

interpreting data. According to Padilla et al. and Rao and Kumari, these skills are seen as the skills that are used in preschool and primary school and should be acquired by students from these levels. Basic scientific process skills based on the more complex integrated scientific process skills forming skills. Observation, classification, measurement, inference, space/time using relationships, using numbers, estimating, drawing conclusions, communication, and asking questions can be counted among the basic scientific process skills. Integrated scientific process skills are more complex, including the use of some basic skills. These skills are used in the research and interrogation process. It includes important mental skills as well as skills. Determining the variables, define relationships between variables, change variables and control making, creating tables, drawing graphics, modeling, obtaining data and data processing, operational definition, setting up a hypothesis, designing an experiment, experimenting, Interpretation of data can be counted among integrated process skills (as cited in Aslan et al. 2016).

Institutions and systems must work in cooperation for the continuation of humanity. Each system and institution is responsible for each other's development. As developing systems and institutions will actually play a role in the development of societies, it is among the aims and policies of societies and systems to enable the acquisition of a number of skills by individuals from early childhood on. At this stage, 21st-century skills defined by different systems become important. The World Economic Forum has revealed 21st-century skills considered for different disciplines such as education, industry, technology, business world, and economy and reported these (The World Economic Forum, n.d.).

In the "Jobs of the Future" report of the World Economic Forum (2016), besides occupations related to artificial intelligence and machine learning, robotics, nanotechnology, three-dimensional printing, genetics and biotechnology, the Fourth Industrial Revolution will lead not only to widespread deterioration not only in business models but also in the labor markets. Moreover, it also predicts that there will be changes in existing skills.

The skills of the workforce to be trained in this field of work are to be acquired at a very early age. In the World Economic Forum (2016) Report, the skills required for students in the 21st century are discussed and determined as follows:

1. Basic Literacy for daily life: literacy, arithmetic, scientific literacy, information and communication technologies literacy, financial literacy, culture, and civil literacy

2. Competencies for complex challenges: critical thinking/problem solving, creativity, communication, cooperation

3. Character Properties that determine the approach to changing situations: curiosity, initiative, perseverance/patience, adaptability, leadership, social, and cultural awareness

It will be in the interest of both the individuals and societies to enable today's children to gain the necessary skills at preschool and subsequent levels of education demanded form the workforce of the future. Therefore, it is necessary to support children with small interventions from an early age on to acquire scientific knowledge, technology literacy, and skills such as critical thinking, problem-solving, creativity, cooperation, and furthermore curiosity, patience, leadership, and socio-cultural awareness. It is through interaction with the environment that children have access to necessary information answering their curiosity and questions about life. Children are in need of supportive environments in which they can obtain the knowledge regarding their development. These environments can be social environments such as family, peer, school, as well as objects and mass media with which they interact by means of their own mental processes. Although they acquire knowledge and skills as a result of the interaction with their environment, children take models from the environments they interact with. Therefore, the structuring of the environment will support the development of children. The object that children interact most is televisions and technological tools, particularly children's programs on television and social media channels, and cartoons on these channels for children.

Children's programs are the types of programs suitable for the developmental characteristics of children, and therefore addressing their tastes and learning abilities. The biggest share in children's programs belongs to cartoons. Cartoons are children's programs that convey messages to children with their scenarios and heroes by bringing life to drawn lines. Turkish Language Institution (n.d.), defines cartoons as follows: It is a movie genre composed of pictures drawn in succession to indicate the movements of their characters related to a subject.

The drawings in which the environment is transferred in color are presented as cartoons, caricature or animations. Sometimes they are published in newspapers and magazines, sometimes they are shown in television and cinemas. Cartoons are used to create education and awareness as well as entertainment. Different methods and technologies should be used in educational processes. Cartoons are used abundantly, as they make learning easier and fun. Cartoons, make monotonous learning processes fascinating. It gives life the dull pages of books and the hidden secrets of the subject. It is attractive. Just by looking at the drawings, it is understood what it says. Cartoons leave memorable marks on preschool children's minds. It can contribute to children if used properly. New generation children tend to learn by examining. They want to find answers to their questions. This situation reveals the need for new techniques in teaching. If cartoons are well featured, they can be advantageous in terms of education (Target Study 2018, September 18).

According to Nair (2019, December 21), cartoons affect children both positively and negatively. Positive effects of watching cartoons on children are; 1. helping children get an early start on learning 2. helping the cognitive development 3. helping the language development 4. enhancing creativity 5. promoting laughter and relieving stress 6. Helps Kids Learn About Different Things. Negative Impact of Watching Cartoons on Kids: 1. Encourages Violence 2. promoting unruly behavior and lack of empathy 3. promoting the use of foul language 4. encouraging antisocial behaviors 5. leading health problems due to sedentary lifestyle. While children learn with fun, their logic and reasoning develop and their creative skills increase. In order to prevent its negative effects, families must first determine the cartoons they will watch together, limit their watch hours, have educational and suitable cartoons to be watched, the differences between the imagination and reality in cartoons should be discussed, and something should not be eaten during watching.

It should be noted that the features of the published cartoons are as important as the families do. That's why the producers have a big duty. The subjects of the cartoons, the characteristics and messages of their heroes should be designed in a way that favorably supports the development of the child.

Recent improvements in screenwriting techniques, technology, and computer-aided production of cartoons have led to the development of cartoons and diversity enabling the emergence of new characters. With the acceptance and recognition of the characters of a particular animation or cartoon, products such as educational games, entertaining games for smartphones or tablets related to the characters, websites, figures of the characters, toys, costumes, printed textile materials are produced. Considering future technologies, it is foreseeable that this sector will continue for many years (Malatyalioglu, 2014).

The presentation of characters, lines, colors, music, songs, plots, and scenes in the cartoons catch children's attention. Their interactions with cartoons make children identify themselves with the characters in their daily lives, revive the scenes they watch and use their imagination to create their own scenarios.

Malatyalioglu (2014) states that thematic cartoons to be produced for education purposes will enable tutorial cartoon examples in which characters from the immediate world of the children like their mother, father, sibling, grandfather, teacher or friend, act as exemplary human beings. Thus, by showing how these characters in the cartoons resolve their problems, children are actually advised. Characters will become role models for the children.

In cartoons, characters can be not only human beings but also animals, technological devices, or totally fictitious non-earthly characters, a product of human imagination. The characters speak, act, and offer skills according to the age and developmental characteristics of the children.

In the cartoons, there are not only virtuous characters and role models, but also characters with opposing features presented and children are made to attempt to perceive the good or the truth, or what has to be in that situation. In fact, cartoons are indicators of the situations that children may encounter throughout their lives.

According to Target Study (2018, September 18), the points where cartoons are important in terms of education are as follows:

1. They are remarkable as it contains color, fun, and line
2. It provides an easy understanding of difficult issues.
3. They improve their language skills.
4. They provide effective teaching of community or human values and good behavior.
5. Rhymes, end-rhymes or numerals, series of numbers and movements in scenes in cartoons are great tools for preschoolers in terms of physical exercises.
6. Children are artists (aesthetics) enough to draw a new cartoon character with their imagination and they establish unity of mind and language and unity of mind and finger.
7. Children develop critical thinking skills to interpret what cartoons say.
8. Children's quantity of vocabulary increases.
9. A positive student-teacher relationship is established as the teacher who offers fun materials such as cartoons will be appreciated against the teacher.
10. It is a cheap tool for teaching due to watch on the internet or television and purchase in the form of books and magazines.

Cartoons are produced in order both to entertain and influence the development of children. Therefore, the content, scenarios, and characteristics of the heroes of the cartoons produced are important. Since knowledge is accessed through science, it is important that cartoons contain images of science. The more interaction with the images of science, the greater is the interest and attraction of children to science.

The mental idea, general appearance, and impression means image (Turkish Language Institution, n.d.). In cartoons, the message to be given is in the form of images. The features that make up the theme are converted into images and presented to the audience.

21st century professions such as artificial intelligence and machine learning, robotics, nanotechnology, three-dimensional printing, and genetics and biotechnology and the skills that 21st century students should acquire such as scientific literacy, information and communication technologies literacy, critical-thinking problem-solving, creativity. It is necessary to ensure that the generations are trained by running all the available opportunities to ensure gains by spreading into daily life, not just with learning at school.

A well-structured interaction and learning environment is necessary in order not to leave the development of children to chance, to prevent false learning, and to prepare children for the future as best as possible. The results of this study are important as along the determination of being selective in choosing the environments to be offered to children. It will guide scenarios of cartoons yet to be produced and the preferences of families in terms of cartoons.

Aim

In the present study is conducted in order to determine the presence of science images in cartoons following research questions will be answered:

1. What is the current condition of cartoons in terms of integrating:
   "science images related to scientific concepts and processes"
   "science images related to scientific research"
   "science images related to physical sciences"
   "science images related to life sciences"
   "science images related to earth and space sciences"
   "science images related to science and technology"
   "science images related to personal and social sciences"
   "science images related to nature and history"
   "science images in its episodes"?
2. What is the current condition of cartoons in terms of integrating science images in its episodes?
3. What is the current condition of the presence of science images within the episodes of a particular cartoon?

Methodology

Research Design

The present study has a Qualitative Single Case (Type 1) research model, a qualitative research method aiming to determine the situation and provide information over a certain period in depth. According to Hancock and Algozzine, case studies are the study of an event or a case under investigation, in its natural context, limited to location and time. Decisions considering the case are made based on the combination of data obtained from measurement tools and data sources (Hancock & Algozzine as cited in Kaleli Yilmaz, 2015). The holistic single case model is the study of situations that no one has ever studied before or was able to reach before. This pattern has the feature of making an unknown situation evident and forming the basis and guiding subsequent research (Yildirim & Simsek, 2018). Likewise, the present study is considered to guide future research in terms of the sample, data collection tool, and research problem.

Universe and Sample

The population of the study consists of cartoons broadcasted at TV channels among the programs for children in Turkey. First, the list of children channels broadcasting on Turkish Satellite (TURKSAT) Cable TV was obtained (TURKSAT, 2019). In order to form the sample of the study, the missions of the channel and target audiences were determined based on the information derived from the websites of 8 Children TV program channels (two belong to TRT Cocuk [Turkish Radio Television Children] channel, one broadcasting in HD) on TURKSAT Cable TV.

Purposive sampling method was preferred while determining the sample. According to Patton, it is the sampling method that gives the opportunity to study the cases that are considered to have splendid data in depth (Patton as cited in Yildirim & Simsek 2018). While analyzing the features of the kids' channels on the relevant sites, it was determined that there is either no explanation at all or only a statement that it is for entertainment purposes. Cartoons that are currently broadcasted on TRT Cocuk channel are taken as the sample as only this channel has activities adhering to the principle of public interest by supporting the healthy development of its target audience, that of the children. TRT Cocuk channel is a thematic channel adhering to the principle of supporting children's development and broadcasting mainly local productions. Moreover, complying with the basic views, goals, and principles of the Turkish National Education is among the important policies of the channel.

The study was initiated in August 2019, the website of TRT Cocuk channel (Turkish Radio Television Children's Channel, 2019) was examined in-depth for sample cartoons, and the number and names of the cartoons were determined. A total of 45 cartoons were determined on the channel's website. The number of cartoons broadcasted was determined by examining the broadcasting streams in August and September, and 35 cartoons were determined and included in the sample of the study. Although the number of cartoons was defined as 35, 9 were excluded from the

study as their previous episodes could not be accessed on the website, so the final number of cartoons to be watched and analyzed was decreased to 26. Table 2 contains information about cartoons determined for sampling.

Table 2. Information about the Cartoons in the Sample

Sequence	Name of the Cartoon		Code	Age Group	Episodes
1	64 Kare Ulkesi	(64 Square Countries)	C1	6-8 years / 9-11 years	31
2	Akilli Tavsan Momo	(Smart Rabbit Momo)	C2	3-5 years	50
3	Ari Maya	(Bee Maya)	-	Not Defined	No Access to Previous Episodes
4	Aslan	(Aslan)	C3	Not Defined	24
5	Biz Ikimiz	(We Both)	C4	Not Defined	46
6	Canim Kardesim	(My Dear Brother)	C5	Not Defined	110
7	Ciciki	(Ciciki)	C6	Not Defined	28
8	Catlak Yumurtalar	(Cracked Eggs)	-	Not Defined	No Access to Previous Episodes
9	Cilgin Orman	(Crazy Forest)	C7	Not Defined	24
10	Dinazor Makineler	(Dinosaur Machines)	-	Not Defined	No Access to Previous Episodes
11	Ege ile Gaga	(Ege and Gaga)	C8	Not Defined	81
12	Elif ve Arkadaslari	(Elif and Elif's Friends)	C9	3-5 years / 6-8 years	32
13	Elif'in Dusleri	(Elif's Dreams)	C10	Not Defined	79
14	Elma Kurdu Nam Nam	(Apple Worm Nam Nam)	-	Not Defined	No Access to Previous Episodes
15	Emiray	(Emiray)	-	Not Defined	It will start broadcasting on September 13, 2019.
16	Hapsuu	(The Achoo)	C11	3-5 years	51
17	Heidi	(Heidi)	-	9-11 years / 12 years and above	No Access to Previous Episodes
18	Ibi	(Ibi)	C12	Not Defined	64
19	Kaf Dagi Masallari	(Kaf Mountain Tales)	C13	3-5 years	11
20	Kardesim Ozi	(My Brother Ozi)	C14	3-5 years / 6-8 years	34
21	Kare	(The Square)	C15	3-5 years	72
22	Keloglan	(Keloglan)	C16	Not Defined	30
23	Kuklali Kosk	(Puppet Mansion)	-	Not Defined	No Access to Previous Episodes
24	Kukuli	(Kukuli)	-	Not Defined	No Access to Previous Episodes
25	Kuzucuk	(Little Sheep)	C17	Not Defined	110
26	Maysa ve Bulut	(Maysa and Bulut)	C18	Not Defined	55
27	Mutlu Oyuncak Dukkani	(Happy Toy Shop)	C19	Not Defined	26
28	Nasreddin Hoca Zaman Yolcusu	(Nasreddin Hodja Time Traveler)	C20	3-5 years / 6-8 years / 9-11 years	14
29	Niloya	(Niloya)	C21	Not Defined	14
30	Pirill	(Piril)	C22	9-11 years	20
31	Rafadan Tayfa	(Rafadan Tayfa)	C23	Not Defined	73
32	Su Elcileri	(Water Ambassadors)	C24	3-5 years	23
33	Sef Roka'nin Lezzet Dunyasi	(World of Taste of Chef Roka)	C25	Not Defined	8
34	Vikigler	(The Vikings)	-	12 years and above	No Access to Previous Episodes
35	Yilki Otu (Doru)	(Yilki Otu (Doru))	C26	Not Defined	11
36	Harflerin Dunyasi	(The World of Letters)	-	3-5 years	
37	Ramazan Guncesi	(Ramadan Diary)	-	6-8 years	
38	Ramazan Tayfa	(Ramadan Tayfa)	-	6-8 years / 12 years and above	
39	Bizim Diyar	(Our Realm)	-	3-5 years	Episode Numbers were not defined as these are no longer broadcasted ot TRT Cocuk channel and not to be included in the sample.
40	Kelile Dimne	(Kelile Dimne)	-	9-11 years / 12 years and above	
41	Barbaros	(Barbaros)	-	9-11 years	
42	Cinar	(Cinar)	-	9-11 years	
43	Harika Isler	(Great Jobs)	-	9-11 years	
44	Anka	(Anka)	-	12 years and above	
45	Kostebekgiller	(The Mole Family)	-	12 years and above	

Table 2 presents 45 cartoons on the channel's website listed in alphabetical order. First, considering the high probability of reaching all children, only cartoons that were broadcasted in August and September were considered and 35 cartoons were decided upon. However, since the cartoons will be watched on the channel's website, the number of episodes of the cartoons to be watched on the channels' web site has been determined. At this stage, cartoons that could not be reached were removed from the sample and the number of cartoons was decreased to 26. These cartoons were coded as Cx (Example: C1, C2, ... , C21). Some of the cartoons in the study sample had defined the age groups addressing to, others had not. There are cartoons addressing to children from 3 to 11 as well as cartoons for over 12 years. Cartoons starting from 36 to 45 were excluded from the sample as these were available on the website but not broadcasted on television. Moreover, some of these cartoons do not have episodes loaded on the channel's website.

Data Collection Tool

National Science Education Standards (NSES), consisting of 8 main and 25 sub-concepts determined by the National Research Council (NRC) (1996, 2003) for kindergarten to elementary school 4th-grade children, was accessed during the review of the relevant literature in order to develop the necessary data collection tool. While the researches are going on, sub-concepts have been created based on the concepts of these standards. While determining the sub-concepts, Science Learning Assessment (SLA) belonging to Samarapungavan, Mantzicopoulos and Patrick and French (2009) was also examined and explanations were added to the sub-dimensions. SLA is a personally managed, instructively sensitive science assessment for kindergarten children. SLA consists of two sub-dimensions, scientific research processes and life sciences concept sub-dimension, and of 24 items in total. While creating the data collection tool, teaching science as an inquiry (Teaching science as an investigation) by Bass et al. (2009), Carin, and Bass (2001), and Carin, et al. (2005) have been studied and the following conclusion reached: a research approach towards the acquisition of scientific skills to be used by children and a scientist would motivate every child, attract students of all kinds, and help them to understand the relation between science and daily life, and the nature of science. After the analysis of the content, the data collection tool has been finalized.

After the data collection tool was created, expert opinion was referred to for validity and reliability purposes. 6 faculty members from the field of Preschool Education and 4 faculty members from the field of Science Education were consulted for their opinions.

The form, prepared for the experts, had columns with headings such as "SUITABLE, NOT SUITABLE, ADD, CORRECT" across each of the dimensions of the data collection tool. For the validity of the data collection tool, the dimensions of the concepts related to the science images in the data collection form were questioned for their appropriateness in terms of theoretical, methodical considerations and as a collection tool per se. According to the feedback obtained from 4 experts, the form was rearranged and some additions made. In order to ensure the reliability of the data collection tool, the experts were consulted once again whether the form was suitable for research, whether it would collect the necessary data, and whether it was relevant to the subject of the research. All experts thought that the form was suitable for the research method, could collect data, and was relevant to the research topic. In terms of reliability, all of them were unanimous. Thus, the form for analyzing scientific image presence in cartoons (FASIPC) has taken its final form. Table 3 shows the 8 sub-dimensions of FASIPC and the descriptions of the 41 sub-concepts:

Table 3. Content of the Form for Analyzing Scientific Image Presence in Cartoons (FASIPC: Form for Analyzing Scientific Images Presence in Cartoons)

Dimensions	Sub Concepts	Explanations
Integration of Scientific Concepts and Processes	Systems, order and organization Evidence, models and explanation Change, stability and measurement Evolution and balance Shape and function	
Research as Science	Skills required to conduct scientific research (basic scientific process skills) (in the early years of preschool and primary education)	Observation Comparison Classification Communication Making Measurements Establishing Space-Time Relationships Guessing Drawing conclusions and interpreting the results Hypothesis formation and testing
	Skills required to conduct scientific research (integrated scientific process skills) (in the upper classes of primary education)	Determining and controlling variables Organizing and conducting experiments Functional Specifications Saving data Data processing and modelling Interpreting and drawing conclusions

Table 3. Continued

Dimensions	Sub Concepts	Explanations
Physical Science	Perceptions about scientific research Properties of objects and materials Position and movement of objects Light, heat, electricity, and magnetism Matter Energy Movement Change Gravity Balance Sound Measurement Direction Color Smell Shade Time	Three states of matter (solid-liquid-gas)
Life Sciences	Properties of living things Life cycles of living things Creatures and their environment Ecology	Plants, Animals, Our Body, The Five Senses
Earth and Space Sciences	Properties of earth materials Objects in the sky (space-space) Changes in the earth and sky	Water, soil, environment Simple geographical forms Map information Star, sun, planets, moon, galaxy Weather and weather events, meteorology Natural events
Science and technology	Skills enabling technological design Perceptions about science and technology Skills needed to differentiate mend made & natural objects	Simple machines, Tools of Science
Science from a Personal & Social Perspective Nature and History of Science	Personal health Population changes and characteristics Resource Types Environmental changes Regional problems in science and technology Contribution of man to science The history of science	

Table 3 presents explanations about the science images to be searched for while watching cartoons in order to collect the necessary data. Hereby, the sub-concepts to be looked for in a dimension to be tested are given together with their explanations. Some sub-concepts have been explained and some sub-concepts have not.

Data Collection

Since cartoons could not be watched live on television at the time of their broadcast due to time constraints, these were watched on the channel's website. Since the programs broadcasted on TRT Cocuk channel are thematic, 10 episodes were randomly determined. The number of episodes watched would answer the considerations about the cartoons. As of September, watching and data collection procedure had begun of the previously selected episodes of the earlier determined 26 cartoons; however, even though earlier accessible, the episodes of 5 cartoons could not be accessed. Hence, 10 episodes randomly selected from the remaining 21 cartoons were watched and analyzed. Table 4 contains information about the randomly selected parts of the 21 cartoons.

Table 4. Episodes of the Cartoons Watched & Analyzed

Code of the Cartoon	Name of the Cartoon	Episodes Watched & English Titles of the Episodes
C1	64 Kare Ulkesi (64 Square Countries)	Episodes : 1,3,5,10,11,15,18,21,24,25
C2	Akilli Tavsan Momo (Smart Rabbit Momo)	Episodes: 1,6,12,49, Tako Has A Trouble, Strange Flower, Gramophone, Mysterious Lights, Sip and Tip in Search of Adventure, Bomb is Looking for a Hobby
C3	Aslan (Aslan)	Common Territory, Wind Meter, Unopenable Jar, Determination of Direction with Voice, Maze Explorers, Holiday Gifts, Gloves, Neighborhood Map, Tent Hammock, Rolled Notebook
C4	Biz Ikimiz (We Both)	Forest, Candle, Space, Sculpture, Five Stones, Autumn, Sun And Moon, Trash, Smartaleck Arda, Heroism
C5	Canim Kardesim (My Dear Brother)	Lighthouse, Museum at Home, Arts Homework, Whose Money it is, A Little Star Has Fallen From The Sky, Save Money, It's Too Hot, Why is the Sun Crying, Holiday On A Deserted Island, Children Olympics
C7	Cilgin Orman (Crazy Forest)	King Raki, Picnic in the Forest, Reconciliation, Chapter 9, Radio in the Forest, Redwood Tree, Cleaning in the Forest, Four Leaf Clover, The Secret of the Forest, The Lesson of the King
C8	Ege ile Gaga (Ege and Gaga)	Necklace, Letter, Light And Sound, Regeneration, Crosstalk, In the Distant, Astronaut Beak, Daytime Sleep, Tiny Wings, If The Cloud Descends To The Ground
C10	Elif'in Dusleri (Elif's Dreams)	Eggplant at the Pole, Bracket, Kite, Airplane, Pumpkin (Cute), The Dessert going to the Neighbor, Welcome Pomegranate, Sweet Kiwi, Tall Leek, Clean World
C11	Hapsuu (The Achoo)	What If I Would be?, It Has Time, Flaky Snow, New Voice New Friend, Puff Puff, Milk Tooth, Let's Meet? Confused Hapsu, Today it is Windy, Don't Let the Eggs Break
C12	Ibi (Ibi)	Ice Island, Glass Island, Old Warehouse, Oasis Island, Big Bank, Guma Forest, Wind Farm, Baldiyar Triangle, Underground Library, Snowman Olympics
C14	Kardesim Ozi (My Brother Ozi)	Ozi Learns the Time, Curious, First Day at School, Big, Captain Pilot Ozi, Ozi Produces Solution, Ozi Forgets, Summer Cinema, Ozi Seeks Treasure, Ozi Meets Other Families
C15	Kare (The Square)	Missing Miners, Four Seasons Shoe Store, Pothole, Fog, The Sailboat on the Rocks, Stubborn Mountaineer, Loud Room, Empty Eggs, Day-Night, Grumpy Sailboat
C16	Keloglan (Keloglan)	Museum, Patisserie, Giant Robot, Lab, Country of Giants, Spider Friend, Dream of Keloglan, The Secret of Bilge Can Grandfather, The Game of Fox in Boots, The Secret of the Moon Stone
C17	Kuzucuk (Little Sheep)	Paint, Sports, Fishing Rod, Rhythm, Experiment, Istop, I am the Hero, Helicopter, Hello Autumn, First Aid Team
C18	Maysa ve Bulut (Maysa and Bulut)	Garbage, Bridge, Cross Section, Letter, Chapter 9, Chapter 10, Key Point, Light Experiment, Cultural Heritage, Nasreddin Hodja
C19	Mutlu Oyuncak Dukkani (Happy Toy Shop)	Fly Fly Basket, Shine Polish, Keep Your Word, My Favorite Movie, Unattended Invitation, My Favorite Toy, Different Talents, Spring Cleaning, Fear not in the Workshop, Tiny Orchestra
C20	Nasreddin Hoca Zaman Yolcusu (Nasreddin Hodja Time Traveler)	Farming, Camping, Extraordinary Sports, Lost, Game Over, No Time Traveler Left Behind, Shopping, Lion Tamer, In the Internet World, Global Warming
C21	Niloya (Niloya)	I ate too much sugar, Tree Roads, Corn Bread, Pocket Chick, Hazelnut Time, Which Color, Calf, Milk, Train, Rainbow
C22	Pirill (Piril)	Find Your Row And Fall Back, We Measure Liquids, Patterns, Head or Tail ?, In Pursuit of Roman Numerals, Efe is Studying, Endless Measurement Homework, Fractions Fill Our Stomach, Mystery of Symmetry, If You Don't Sweat You Will Get Wet
C23	Rafadan Tayfa (Rafadan Tayfa)	Hidden Treasure, Expensive Ball, Purity Issue, Rafadan Tv, Return of Tamtam, Smart Computer, Chek mate, Observatory, Meatball Recipe, Rafadan Soft Drinks
C24	Su Elcileri (Water Ambassadors)	Rain, Erosion, Natural Mines, Zebra Mussels, Waters Rising, Where Water Goes, Wastes Correctly Disposed, Fire, Salty, Water of Cactus

Table 5 includes the chapters selected and watched randomly from the cartoons. The episodes of some cartoons were numbered by the channel's website, others had to be enumerated by the researcher.

Table 5. Information about the Episodes Watched

Number of Cartoons Watched	Number of Episoded watched for each cartoon	Number of Episodes in Total	Shortest Episode	Longest Episode	Total Watching Time	Average Watching Time for Each Episode
21	10	210	03.10 Minutes SU ELCILERI (Water Ambassadors) Yagmur (Rain)	15.29 Minutes RAFADAN TAYFA (Rafadan Tayfa) Gizli Hazine (Hidden Treasure)	2166.48 Minutes (36 hours, 01 minute 48 seconds)	10.32 minutes

Table 5 presents information about the cartoons watched. In total 210 episodes had been watched, ten episodes from 21 different cartoons. Total time spend for watching was 36 hours, 01 minutes, 48 seconds. The average episode duration was 10 minutes, 32 seconds.

Analyzing of Data

Analysis of the data obtained was based on document analysis. Analysis of documents, according to Yildirim and Simsek (2018), is the analysis of written materials that have information about the case or cases analysed. In qualitative research, in cases where direct observation and interview are not possible or to increase the validity of the research, besides interview and observation methods, written and visual materials and materials related to the research problem can also be included in the research. The importance of the documents used as a data resource is related to the research problem. Visual materials such as film, video, and photography images can also be employed in qualitative research.

The cartoons watched were evaluated using FASIPC. A FASIPC was developed for each cartoon and the science images were determined for the 10 episodes watched. The evaluation was made with the forms of each cartoon and of the 10 episodes were watched for each cartoon. In the evaluation process, three issues were considered: 1. If there was only one sub-concept present in the episode, the science image of the dimension to which the subconcept belongs to was considered to be present, hence the number of repetitive images of the same dimensions were not counted 2. In addition, no extra scoring was made, only the existence of the science image was evaluated. 3. As there were cartoons stating target audience age groups and cartoons without, age was not taken as a criterion during data analysis. In this regard, the fact that the achievements regarding science images are included in the programs of all education levels starting from the pre-school education program on of the Turkish Ministry of National Education supports this decision.

Findings

The findings consist of the data obtained from the presence of science images present in the cartoons watched.

Finding Related to the Presentation of Integration of Scientific Concepts and Processes in the Cartoons

Table 6 presents information related to the integration of scientific concepts and processes in 21 cartoons watched.

Table 6. Inclusion of scientific concepts and processes integration in the cartoons

Cartoon Code	Cartoon Name	f	%
C22	Piril	9	15,8
C3	Aslan	7	12,3
C1	64 Kare Ulkesi	6	10,5
C10	Elif'in Dusleri	6	10,5
C23	Rafadan Tayfa	5	8,8
C24	Su Elcileri	5	8,8
C2	Akilli Tavsan Momo	4	7
C8	Ege ile Gaga	4	7
C12	Ibi	2	3,6
C15	Kare	2	3,6
C20	Nasreddin Hoca Zaman Yolcusu	2	3,6
C4	Biz Ikimiz	1	1,7
C11	Hapsuu	1	1,7
C16	Keloglan	1	1,7

Table 6. Continued

Cartoon Code	Cartoon Name	f	%
C18	Maysa ve Bulut	1	1,7
C21	Niloya	1	1,7
C5	Canim Kardesim	0	0
C7	Cilgin Orman	0	0
C14	Kardesim Ozi	0	0
C17	Kuzucuk	0	0
C19	Mutlu Oyuncak Dukkani	0	0
	TOTAL	**57**	**100**

According to Table 6, out of the 210 episodes watched, only 57 episodes included integrating scientific concepts and processes. The highest rate, with 15.8%, belongs to the cartoon named "Piril" (The Piril) coded as C22 that has included integrating scientific concepts and processes in 9 out of the 10 episodes watched. The cartoons with the lowest rate (0%) are the 5 cartoons coded C5/C7/C14/C17/C19 as these did not have had in any of their episodes scientific images related to the integration of scientific concepts and processes.

Inclusion of Scientific Research in the Cartoons

Table 7 presents information about the inclusion of scientific research in the episodes of the 21 cartoons watched.

Table 7. Inclusion of scientific research in the Cartoons

Cartoon Code	Cartoon Name	f	%
C3	Aslan	10	15,9
C2	Akilli Tavsan Momo	8	12,8
C8	Ege Ile Gaga	8	12,8
C15	Kare	7	11,1
C23	Rafadan Tayfa	5	7,9
C1	64 Kare Ulkesi	4	6,3
C20	Nasreddin Hoca Zaman Yolcusu	4	6,3
C11	Hapsuu	3	4,8
C4	Biz Ikimiz	2	3,1
C16	Keloglan	2	3,1
C24	Su Elcileri	2	3,1
C10	Elifin Dusleri	1	1,6
C12	Ibi	1	1,6
C14	Kardesim Ozi	1	1,6
C17	Kuzucuk	1	1,6
C18	Maysa Ve Bulut	1	1,6
C19	Mutlu Oyuncak Dukkani	1	1,6
C21	Niloya	1	1,6
C22	Piril	1	1,6
C5	Canim Kardesim	0	0
C7	Cilgin Orman	0	0
	TOTAL	**63**	**100**

According to Table 7, out of the 210 episodes watched, 63 episodes contain elements of scientific research. The highest rate, with 15.9%, belongs to the cartoon named "Aslan" (Aslan) coded as C3 in which scientific research elements were included in all 10 episodes watched. Cartoons with the lowest ratio (0%) are 2 cartoons coded as C5 and C7. No science images were present in any of the sections watched.

Inclusion of physical sciences in the Cartoons

Table 8 presents information on inclusion of physical sciences in the episodes of the 21 cartoons.

Table 8. Inclusion of physical sciences in the cartoons

Cartoon Code	Cartoon Name	f	%
C12	Ibi	10	8,6
C19	Mutlu Oyuncak Dukkani	10	8,6
C3	Aslan	9	7,7
C17	Kuzucuk	9	7,7
C1	64 Kare Ulkesi	8	6,8

Table 8. Continued

Cartoon Code	Cartoon Name	f	%
C15	Kare	8	6,8
C2	Akilli Tavsan Momo	7	6
C18	Maysa Ve Bulut	6	5,2
C4	Biz Ikimiz	5	4,3
C8	Ege Ile Gaga	5	4,3
C22	Piril	5	4,3
C5	Canim Kardesim	4	3,4
C10	Elifin Dusleri	4	3,4
C16	Keloglan	4	3,4
C20	Nasreddin Hoca Zaman Yolcusu	4	3,4
C23	Rafadan Tayfa	4	3,4
C7	Cilgin Orman	3	2,6
C11	Hapsuu	3	2,6
C14	Kardesim Ozi	3	2,6
C24	Su Elcileri	3	2,6
C21	Niloya	2	1,7
	TOTAL	**116**	**100**

According to Table 8, physical sciences are included in 116 episodes out of the 210 episodes watched in total. The highest rate, with 8.6%, belongs to the movie named " Mutlu Oyuncak Dukkani " (Happy Toy Shop) coded as C12 and "Ibi" (The Ibi) coded as C19 as these included physical sciences in all the episodes watched. Cartoons with the lowest ratio (1.7%) regarding the inclusion of physical sciences are 1 cartoon coded as C21 (The Niloya). Only two physical science-related image was present in the episodes watched.

Inclusion of life sciences in the cartoons

Table 9 presents the inclusion of life sciences in the episodes of the 21 cartoons watched.

Table 9. Inclusion of life sciences in the cartoons

Cartoon Code	Cartoon Name	f	%
C7	Cilgin Orman	10	8
C5	Canim Kardesim	9	7,3
C20	Nasreddin Hoca Zaman Yolcusu	9	7,3
C11	Hapsuu	8	6,5
C18	Maysa Ve Bulut	8	6,5
C10	Elifin Dusleri	7	5,6
C24	Su Elcileri	7	5,6
C2	Akilli Tavsan Momo	6	4,9
C4	Biz Ikimiz	6	4,8
C15	Kare	6	4,9
C16	Keloglan	6	4,9
C21	Niloya	6	4,9
C14	Kardesim Ozi	5	4
C17	Kuzucuk	5	4
C23	Rafadan Tayfa	5	4
C3	Aslan	4	3,2
C8	Ege Ile Gaga	5	4
C12	Ibi	4	3,2
C1	64 Kare Ulkesi	3	2,4
C22	Piril	3	2,4
C19	Mutlu Oyuncak Dukkani	2	1,6
	TOTAL	**124**	**100**

According to Table 9, life sciences are included in a total of 124 episodes out of the 210 episodes watched. The highest rate, with 8%, belongs to the cartoon "Cilgin Orman" (Crazy Forest) coded as C7 in which images related to life sciences are included in all 10 episodes watched. The cartoons with the lowest rate (1.6%) are the cartoons named "Mutlu Oyuncak Dukkani" (Happy Toy Shop) coded as C19. Only in two episodes an image of life science was detected of this cartoon.

Inclusion of earth and space sciences in the cartoons

Table 10 provides information about the inclusion of scientific images related to world and space sciences in the episodes of the 21 cartoons watched.

Table 10. Inclusion of earth and space sciences in the cartoons

Cartoon Code	Cartoon Name	f	%
C12	Ibi	8	8
C15	Kare	8	8
C18	Maysa Ve Bulut	8	8
C24	Su Elcileri	8	8
C2	Akilli Tavsan Momo	7	7
C5	Canim Kardesim	7	7
C3	Aslan	6	6
C4	Biz Ikimiz	6	6
C8	Ege Ile Gaga	5	5
C14	Kardesim Ozi	5	5
C20	Nasreddin Hoca Zaman Yolcusu	5	5
C10	Elifin Dusleri	4	4
C11	Hapsuu	4	4
C16	Keloglan	4	4
C23	Rafadan Tayfa	4	4
C17	Kuzucuk	3	3
C19	Mutlu Oyuncak Dukkani	2	2
C21	Niloya	2	2
C22	Piril	2	2
C1	64 Kare Ulkesi	1	1
C7	Cilgin Orman	1	1
	TOTAL	**100**	**100**

According to Table 10, only in a total of 100 episodes out the 210 episodes watched, science images related to Earth and space sciences were included. The highest rate, with 8%, belongs to the cartoons named "Ibi" (The Ibi) coded as C12, "Kare" (The Square) coded as C15, "Maysa ve Bulut" (Maysa and Bulut) coded as C18, and " Su Elcileri " (Water Ambassadors) coded as C24 with earth and space sciences related images in eight of the 10 episodes watched. The cartoons that have the lowest rate (1%) are the cartoons named "64 Kare Ulkesi " (64 Square Country) coded as C1 and " Cilgin Orman " (Crazy Forest) code as C7. Only one earth and space sciences related science image was determined within the episodes of these cartoons watched.

Inclusion of science and technology in the cartoons

Table 11 contains information about the inclusion of science and technology in the episodes of 21 cartoons watched.

Table 11. Inclusion of science and technology in the cartoons

Cartoon Code	Cartoon Name	f	%
C2	Akilli Tavsan Momo	10	8,5
C12	Ibi	10	8,5
C3	Aslan	9	7,7
C11	Hapsuu	9	7,7
C15	Kare	9	7,7
C16	Keloglan	9	7,7
C19	Mutlu Oyuncak Dukkani	8	6,8
C20	Nasreddin Hoca Zaman Yolcusu	8	6,8
C17	Kuzucuk	6	5,1
C22	Piril	6	5,1
C23	Rafadan Tayfa	6	5,1
C4	Biz Ikimiz	5	4,3
C18	Maysa Ve Bulut	5	4,3
C5	Canim Kardesim	4	3,4
C14	Kardesim Ozi	3	2,7
C7	Cilgin Orman	2	1,7
C8	Ege Ile Gaga	2	1,7
C10	Elifin Dusleri	2	1,7

Table 11. Continuedrtoons

Cartoon Code	Cartoon Name	f	%
C24	Su Elcileri	2	1,7
C1	64 Kare Ulkesi	1	0,9
C21	Niloya	1	0,9
	TOTAL	**117**	**100**

According to Table 11, out of the 210 episodes watched, 117 episodes include images related to science and technology. The highest rate, with 8.5%, belong to the cartoons named "Akilli Tavsan Momo " (Smart Rabbit Momo) coded as C2 and "Ibi" (Ibi) coded as C12 with science and technology images in all the 10 episodes watched. The cartoon with the lowest ratio (0.9%) is "64 Kare Ulkesi" (64 Square Country) coded as C1 and "Niloya" (Niloya) coded as C21. Out of the 10 episodes watched, only one image related to science and technology was determined.

Inclusion of science from a personal and social perspective in the cartoons

Table 12 presents information about the inclusion of science from a personal and social perspective in the 21 cartoons watched.

Table 12. Inclusion of science from a personal and social perspective in the cartoons

Cartoon Code	Cartoon Name	f	%
C12	Ibi	9	11,4
C10	Elifin Dusleri	8	10,1
C24	Su Elcileri	7	8,9
C14	Kardesim Ozi	5	6,3
C18	Maysa Ve Bulut	5	6,3
C20	Nasreddin Hoca Zaman Yolcusu	5	6,3
C21	Niloya	5	6,3
C7	Cilgin Orman	4	5,1
C11	Hapsuu	4	5,1
C22	Piril	4	5,1
C3	Aslan	3	3,8
C15	Kare	3	3,8
C16	Keloglan	3	3,8
C17	Kuzucuk	3	3,8
C19	Mutlu Oyuncak Dukkani	3	3,8
C1	64 Kare Ulkesi	2	2,5
C4	Biz Ikimiz	2	2,5
C5	Canim Kardesim	2	2,5
C2	Akilli Tavsan Momo	1	1,3
C23	Rafadan Tayfa	1	1,3
C8	Ege Ile Gaga	0	0
	TOTAL	**79**	**100**

According to Table 12, out of the 210 episodes watched in total, only 79 episodes include scientific images related to science from a personal and social perspective. The highest rate, with 11.4%, belongs to the cartoon named "Ibi" (Ibi) coded as C12 as it included in 9 out of the 10 episodes watched images of science from a personal and social perspective. The cartoon with the lowest rate (0%) is the cartoon named "Ege ve Gaga" (Ege and Gaga) coded as C8. No science image from a personal and social perspective was encountered in any of the episodes of this cartoon.

Inclusion of science nature and history in cartoons

Table 13 presents images regarding the nature and history of science present within the 21 cartoons watched.

Table 13. Inclusion of science nature and history in cartoons

Cartoon Code	Cartoon Name	f	%
C3	Aslan	5	20,8
C20	Nasreddin Hoca Zaman Yolcusu	5	20,8
C16	Keloglan	4	16,7
C2	Akilli Tavsan Momo	3	12,5
C23	Rafadan Tayfa	3	12,5
C11	Hapsuu	1	4,1
C17	Kuzucuk	1	4,1

Table 13. Continued

Cartoon Code	Cartoon Name	f	%
C19	Mutlu Oyuncak Dukkani	1	4,1
C21	Niloya	1	4,1
C1	64 Kare Ulkesi	0	0
C4	Biz Ikimiz	0	0
C5	Canim Kardesim	0	0
C7	Cilgin Orman	0	0
C8	Ege Ile Gaga	0	0
C10	Elifin Dusleri	0	0
C12	Ibi	0	0
C14	Kardesim Ozi	0	0
C15	Kare	0	0
C18	Maysa Ve Bulut	0	0
C22	Piril	0	0
C24	Su Elcileri	0	0
	TOTAL	**24**	**100**

According to Table 13, in the 210 episodes watched in total, only 24 episodes contained images referring to the nature and history. The highest rates, with 20.8%, belong to the cartoons titled "Aslan" (Aslan) coded as C3 and "Nasreddin Hoca Zaman Yolcusu" (Nasreddin Hodja Time Traveller) coded as C20 as these two cartoons contained images referring to the nature and history of science in all the episodes watched. The cartoons with the lowest ratio (0%) are 12 cartoons coded as C1/C4/C5/C7/C8/C10/C12/C14/C15/C18/C22/C24 as these did present any images referring to the nature and history of science in any of episodes.

Presence of science images in the cartoons

Table 14 presents information about the presence of the science images sub-dimensions in the 210 episodes of the 21 cartoons watched.

Table 14. Presence of science images in the cartoons

Concepts	f	%
Integration of Scientific Concepts and Processes	57	8,4
Science as a Research	63	9,3
Physical Science	116	17,1
Life Sciences	124	18,2
Earth and Space Sciences	100	14,7
Science and technology	117	17,2
Science from a Personal & Social Perspective	79	11,6
Nature and History of Science	24	3.5
TOTAL	**680**	**100**

According to Table 14 within the 210 episodes of the cartoons watched; considering the integration of scientific concepts and processes sub-dimension related images were present in 57 sections, science as a research sub-dimension related images in 63 sections, physical science sub-dimension related images in 116 sections, life sciences sub-dimension related images in 124 sections, earth and space sciences sub-dimension related images in 100 sections, science and technology sub-dimension related images in 117 sections, science from a personal and social perspective sub-dimension related images in 79 sections, and nature and history of science sub-dimension related images in 24 sections. A total of 680 science images have been identified in the 210 sections of 21 different cartoons watched. The most common science images were related to life sciences with 124 sections presence and the least to the sub-dimension of nature and history of science with 24 sections.

Presence of science images within the episodes of a particular cartoon

Table 15 presents information about the presence of science images, regardless of sub dimensions, within the 10 episodes of the 21 cartoons watched.

Table 15. Distribution of science images within the episodes of each cartoon

Cartoon Code	Cartoon Name	f	%
C3	Aslan	53	7,8
C2	Akilli Tavsan Momo	46	6,8
C12	Ibi	44	6,6

Table 15. Continued

Cartoon Code	Cartoon Name	f	%
C15	Kare	43	6,3
C20	Nasreddin Hoca Zaman Yolcusu	42	6,2
C18	Maysa Ve Bulut	34	5
C24	Su Elcileri	34	5
C11	Hapsuu	33	4,8
C16	Keloglan	33	4,8
C23	Rafadan Tayfa	33	4,8
C10	Elifin Dusleri	32	4,7
C22	Piril	30	4,4
C8	Ege Ile Gaga	29	4,3
C17	Kuzucuk	28	4,1
C4	Biz Ikimiz	27	4
C19	Mutlu Oyuncak Dukkani	27	4
C5	Canim Kardesim	26	3,8
C1	64 Kare Ulkesi	25	3,7
C14	Kardesim Ozi	22	3,2
C7	Cilgin Orman	20	2,9
C21	Niloya	19	2,8
	TOTAL	**680**	**100**

According to Table 15, the evaluation of each cartoon in itself revealed that the most science images, 53 in total (7.8%), were present in the cartoon named "Aslan" (Aslan) coded as C3. The theme of the cartoon: The antagonist of the cartoon can not stop imagining new tools for different problems and solves the issues that he is curious about with the help of his grandfather. Our hero and his friends enjoy discovery and fun with new and interesting inventions (Guler, E. (Writer) and Gungor, H. S. (Director). 2019, September 20).

When each cartoon is evaluated in particular, the cartoon with the least amount of science images within the 10 episodes is "Niloya" (Niloya) coded as C21 with 19 (2.8%) include science images. The theme of the cartoon: Niloya hosts friendship, happiness, nature, and adventures in this adventure-filled world. The events are built around the main character Niloya (Demirel Birinci, A. (writer) & Cam, M. (Director), 2019, September 29).

Discussion

Moreover, the present study has determined that while creating scenarios for the cartoons, science images used in daily life are mostly included. However, scientific images based on creative and critical thinking skills are minimally present, and science images related to the history of science, scientist, and science are among the least used science images in cartoon scenarios.

Providing children with realistic images about science and scientists throughout their education, making programs for the introduction of science and scientists and studies on the changes of children's perception on these are among the research proposals of Guler and Akman (2006). In their study, Akman et al. (2003) stated that educators should be encouraged to create an environment that allows children to think and to be interested in science, and that they should support children to think and to make suggestions about objects, events, and people. Moreover, they highlighted the necessity of considering social and cognitive development as a whole within a good program.

Yagli (2013) suggests that the cartoons chosen for the sample of the study aim both to teach Turkish culture and to entertain children. While choosing cartoons for the children, not only the age but also the content of cartoons is to be taken into consideration. He pointed out that cartoon watching habits of children will lead to significant problems in their future educational lives.

According to Oruc et al. (2011), preschool children are curious about everything and wants to learn. At this age, perception of everything around him/her as alive (animism) attributing human features to abstract beings (anthropomorphism), imitation of everything perceived are among the developmental features of these age groups. Modeling, imitation, identification and adoption are realized with the contribution of the environment. In addition, in their research, they concluded that the children model the characters who share common characteristics, in both real life and cartoons, and the life experiences of the heroes contribute to the mental development of children.

In their research, Ayvaci and Abdusselam (2012) stated that the use of cartoons in science education increases the success scores of children. Asci (2006) determined that the animation characters that children watch in advertisements, purchase of the products advertised, or forcing parents to buy the products with cartoon or anime figures on them differed according to the habitat of children. These results support the emergence of the present study. The content of the cartoons, affection of the children by the cartoons features and identifying with the heroes of the

cartoons make children start to live the cartoons. Therefore, the scenarios and drawings of the cartoons should be created meticulously.

In their research, Bayir and Gulsen (2017) have reached the conclusion that the basic scientific facts and concepts are not sufficient in the most-watched cartoons and that the cartoons are insufficient in introducing children to some basic scientific concepts and have recommended that cartoon producers and scriptwriters should get support from the experts. The results and suggestions are in line with the results and suggestions of the present study.

Based on the suggestion made by Yurt and Omeroglu (2013) in their study, cartoons support children while learning science topics. Hence, the results of this study can be a guide for educators as well as parents for using cartoons as an educational material. All kinds of materials that will be used in the education of children should include features that are necessary for science and that will increase their creativity, reasoning, perception and skills of research.

However, irrelevant to the cartoon theme, presenting science images in the cartoons has become a necessity of the age and current life. Children are now interested in robotic coding, mind games, STEM education and practice from preschool on and increase their science-related interests and skills.

Conclusion

Based on the findings of the present study, the following conclusions were reached:

1. The number of chapters containing the image "scientific concepts and processes integration" is 57. It has a low rate of 27.1% in 210 departments.

   The number of episodes containing the image "science-based on research" is 63. Within 210 episodes, it has a low rate of 30%.

   The number of episodes containing the "physical sciences" image is 116. It has an average rate of 55.2% within 210 divisions.

   The number of episodes containing the image of "life sciences" is 124. It is slightly above average with a rate of 59%.

   The number of sections containing the image of "earth and space sciences" is 100. It has an average rate of 47.6%.

   The number of episodes that include the image of "science and technology" is 117, which is slightly above average with 55.7% in 210 episodes.

   The total number of episodes with the image of "a personal and social perspective" is 79, and has a low rate of 37.6% within 210 episodes.

   The number of episodes containing the image of "science nature and history" is 24 in total and has the lowest rate among other images with 11.4% in 210 episodes.

2. "The Presence of science images in the cartoons" status is analyzed, which have tried to determine the location of image portions and image science 680 monitoring section 210 unlike in total were identified. While there are 3.2 images per episode, there are 32.4 images per cartoon. most places the image of science in sections, with section 124 Life Sciences, at least place the image of science is part of the Nature of Science and History with 24 images.

3. It was determined that the situation of including science images in the monitored parts of 21 cartoons was evaluated on the basis of each episode of each cartoon, and in some parts, more than one image of the same science was included. The cartoon, which has the highest proportion of science images, has become the "Aslan" coded C3. A total of 53 images were detected in 10 sections. Most "scientists as research" has included the image. Images of basic scientific process skills, integrated scientific process skills, and also scientific research and perceptions sub-dimensions were found. The section with the most images is the section called "labyrinth explorers". The section that contains the least science element is the section called "holiday gifts". The cartoon that has the lowest proportion of science images is "Niloya". 19 images were identified and the most common image type was "life sciences", 6 sections were identified. The section that has the most science images is "Rainbow".

In accordance with the developmental features of the children, the target audience, and the National Education programs, cartoons published in the TRT Cocuk channel include science images mostly according to their thematic features. Moreover, although cartoons do not have science as their primary themes, they contain images of science.

The present study has determined that the least used science images in the cartoons are related to the sub-dimensions of "Nature and History of Science" (3.5%), "Integrating Scientific Concepts and Processes" (8.4%) and "Science-Based on Research" (9.3%), "Science from Personal and Social Perspective" (11.6%). While the most common images in the cartoons are related to the sub-dimensions of "Life Sciences" (18.2%), "Science and Technology" (17.2%), "Physical Science" (17.1%) and "Earth and Space Sciences" (14,7%), throughout the 210 episodes their rate is slightly above 50%. However, this ratio is also considered to be low in children's interaction with science.

Suggestions

According to the results of this study, a similar study could be made with other children channels broadcasting in Turkey or in another country. In the research, it is thought that the images of "Nature and History of Science", which are the least included in the cartoons, "Science from Personal and Social Perspective", "Integrating Scientific Concepts and Processes", and "Science Based on Research" should be included in the scenarios to be written next. In addition, while creating the scenarios of cartoons, the images of science, which are mostly used in daily life, should be included, and images related to the history of science, scientists and science based on creative and critical thinking skills. Although the research has been carried out on the sample of TRT Cocuk channel, it is also necessary to carefully create the cartoons and scenarios in children's channels that broadcast in the world with the universal idea that new generations should be prepared from preschool period to science, scientific thinking, scientific literacy. It is recommended that new cartoon scenarios with images of science are to be written. All kinds of materials to be used in the education of children should include features that will increase their perception of creativity, reasoning, and research skills. Based on the results of the researching a TV programme that will increase scientific literacy and scientific skills in children may be prepared and the determined cartoons may be watched and their effect should be observed. Also thematic cartoons anthology can be created by evaluating more cartoons and cartoon episodes. Parents can be advised to have their determined cartoons be watched by children.

Limitations

This research is limited to analysis of data are obtained by watching totally 210 episodes which were selected randomly from 21 cartoons with their samples. Accessibility and site availability of TRT Cocuk channel website is limited to determine sample and watching cartoons to aim collecting data. Data collecting tool is limited form which was created as a result of the literature review. Additionally, researcher's process of collecting and analyzing data is limited.

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Appendix: Distribution of Cartoons Installing Science Images

CONCEPTS \ CARTOONS	C1	C2	C3	C4	C5	C7	C8	C10	C11	C12	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	f	%
Integration of Scientific Concepts and Processes	6	4	7	1	0	0	4	6	1	2	0	2	1	0	1	0	2	1	9	5	5	57	8,4
Science as a Research	4	8	10	2	0	0	8	1	3	1	1	7	2	1	1	1	4	1	1	5	2	63	9,3
Physical Science	8	7	9	5	4	3	5	4	3	10	3	8	4	9	6	10	4	2	5	4	3	116	17,1
Life Sciences	3	6	4	6	9	10	5	7	8	4	5	6	6	5	8	2	9	6	3	5	7	124	18,2
Earth and Space Sciences	1	7	6	6	7	1	5	4	4	8	5	8	4	3	8	2	5	2	2	4	8	100	14,7
Science and technology	1	10	9	5	4	2	2	2	9	10	3	9	9	6	5	8	8	1	6	6	2	117	17,2
Science from a Personal & Social Perspective	2	1	3	2	2	4	0	8	4	9	5	3	3	3	5	3	5	5	4	1	7	79	11,6
Nature and History of Science	0	3	5	0	0	0	0	0	1	0	0	0	4	1	0	1	5	1	0	3	0	24	3.5
f	25	46	53	27	26	20	29	32	33	44	22	43	33	28	34	27	42	19	30	33	34	680	100
%	3,7	6,8	7,8	4	3,8	2,9	4,3	4,7	4,8	6,6	3,2	6,3	4,8	4,1	5	4	6,2	2,8	4,4	4,8	5		