

An Examination of Informational Children's Picture Books Prepared For Preschool Children in Terms of Scientific Process Skills

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Abstract

The aim of the study is to examine informational children's picture books prepared for preschool children in terms of scientific process skills. The study was conducted using the document review method, one of the qualitative research methods, and descriptive analysis method was used in the analysis of the data. Within the scope of the research, 18 books in the "Science Solves It" series prepared for preschool children by TUBITAK publications were first analyzed in terms of scientific content, and then analyzed according to 17 scientific process skills under the headings of basic process, causal process, and experimental process skills as a result of the scans in the field literature. As a result of the research, it was found that informational children's picture books in the Science Solves It series from TUBITAK publications were mostly prepared for the field of life science within the framework of science standards, and they were insufficient in terms of providing a scientist image to preschool children and presenting historical knowledge of science. In terms of scientific process skills, it was found that basic process skills were used more. Among the basic process skills, it was found that the communication skill and observation skill were included the most, while the measurement skill and the use of number/space relationships skill were included the least.

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Introduction

Scientific process skills are skills that enable children to access scientific knowledge, raise awareness of how science works, and give children a sense of responsibility for their own learning (Harlen, 1999). Scientific process skills are skills that encompass the basic activities of scientists and help us understand our experiences in discovering knowledge. These skills are considered an important part of mental development and are frequently used in daily life (Aslan, Kılıç & Kılıç, 2016). Science education plays a critical role for the future of societies and many countries are making great efforts to improve the quality of science education (Balbag et al., 2016). In our country, existing science programs are periodically renewed to reflect scientific,

technological, economic advances and social needs (Eskicumalı et al., 2014). Informational children's picture books for preschool children and preschool teachers are the main tool for implementing the qualities assigned to educational programs in the classroom during this renewal process (Kotaman & Tekin, 2017; Monhardt & Monhardt, 2016). In support of this view, a study by Doğanay Koc (2022) found that informational children's picture books are effective in imparting scientific concepts to preschool children. Similarly, many studies in the field literature show that these books are important for children's scientific concept development (Ganea et al., 2011; Hisiao & Sihih, 2016). The content of informational children's picture books prepared for preschool children to learn science concepts correctly and develop their scientific vocabulary is prepared taking into account the developmental characteristics of children. These types of books provide an important contribution by triggering children's curiosity and helping them to correctly identify science concepts. Kralina (1993) states that the use of illustrated children's books, especially from pre-school age onwards, is appropriate in science education. These books provide children with a summary of science concepts and facilitate adaptation to real life. Similarly, Bingham et al. (2018), Mantzicopoulos and Patrick (2011), Pringle and Lamme (2005), and Strouse, Nyhout and Ganea (2018) state that illustrated children's books that provide science-themed information offer an important opportunity for science learning in the pre-school period. Therefore, it is concluded that informational children's Picture books are an important resource for children to learn and develop science concepts and their use in the pre-school period can be beneficial. In the literature, there are studies that have examined illustrated children's books in terms of scientific process skills and STEM education (Alabay & Yağan Güder, 2015; Bicer et al., 2021; Erhan, 2019) and research has been found that examines the science content (Aksüt, 2021; Brommel & Rearden, 2006; Sackes et al., 2009; Yılmaz Genc & Özen Uyar, 2016). However, no research has been found that specifically examines which types of scientific process skills are included in informational children's picture books prepared with the aim of providing scientific support to children. Based on this point, the aim of this research is to examine informational children's picture books prepared for pre-school children in terms of scientific process skills.

Method

In the research, the document analysis method, one of the qualitative research methods, was used. Document analysis is the provision of data by analyzing written sources related to the

research topic (Yıldırım & Simşek, 2011). This method is used as a way of collecting and analyzing data and can be defined as a technique used to determine the boundaries of physical resources, categorize, investigate and interpret them (Ozkan, 2019).

Study Group

Within the scope of the research, 18 informational children's picture books from the "Science Solves It" series published by TUBITAK publications and prepared for pre-school children were examined.

Data Collection Tool and Data Analysis

In this research, the descriptive analysis method was used for data analysis. In descriptive analysis, a framework is created based on the conceptual structure of the research and data is collected and analyzed under predetermined categories and themes in accordance with this framework (Baltacı, 2019). The 18 informational children's picture books from the "Science Solves It" series published by TUBITAK publications were first analyzed in terms of their scientific content. For this purpose, the science concepts in the content of the books were analyzed according to which science standards area they belonged to (Greenfield et al., 2009) based on 3 main areas: "life sciences", "space sciences" and "physical-energy sciences", how scientific concepts were presented to children within a scientific dialogue, and whether they contributed to the image of a scientist and awareness of the history of science. At the same time, in order to determine which scientific process skills the 18 informational children's picture books from the "Science Solves It" series published by TUBITAK publications are aimed at developing, the skills to be analyzed were first determined. For this purpose, as a result of the literature review, the books were analyzed according to 17 scientific process skills under the headings of basic process, causal process and experimental process skills organized by Bayır and Kahveci (2022).

Reliability of Research

The inter-coder reliability formula proposed by Miles and Huberman (1994) was used to determine the reliability of the research. After the codings were completed, the inter-coder reliability was found to be 93% as a result of the calculation.

Findings

In the research where informational children’s picture books prepared for preschool children were examined in terms of scientific process skills, the analysis of the scientific content of informational children’s picture books in the Science Solves It series from TUBITAK publications is shown in Table 1.

Table 1

Analysis of the Scientific Content of Informational Children’s Picture Books in the Science Solves It Series from TUBITAK Publications

Books	Science Standards	Scientific Concept in the Book	Example of a Sentence in which the Scientific Concept Appears	Image of a Scientist	History of Science
1. Buried in Backyard	Life Science	Dinosaur Mammoth	- “After all, this is also a prehistoric animal! Okay, much later than dinosaurs but still lived thousands of years ago.” -“Mammoths lived during the Ice Age.”	Fossil scientist	Paleontologist Mammoths lived during the Ice Age
2. Almost Invisible Irene	Life Science	Camouflage in animals Chameleon Polar bear Snowshoe hare Snowy owl	- “Camouflage!” said Mrs. Meltem. - “Some animals adapt their appearance to their environment to protect themselves from danger.”	-	-
3. Ant Attack	Life Science	Ants Colony	- “The first ant left a scent trail for the others to follow.” So that’s why the other ants headed for the shelf.”	-	-
4. Bears on the Brain	Life Science	Animal tracks Raccoon	- “Emre measured the length of the tracks. “The front paws are 5 centimeters,” he said. “Okay, this is definitely a raccoon.	-	-
5. Picky Peggy	Life Science	Nutrition Egg	- “Just hatched from the egg, six tiny ducklings! Their colors were yellow, their feathers soft, their	-	-

		Beak.	eyes black, and their feet and beaks were orange.”		
6.Creeping Tide	Space Sciences	Tide	- “I see tide pools on the beach. I also look at the larger pools of water left behind by the receding ocean for a long time.”	-	-
7.The Green Dog	Life Science	Algae	- “Hmm... because of the plants?” I guessed. “But I can’t see any roots or leaves,” said Barış. “You’re looking at green water algae,” said Ferit.	-	-
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8.What Homework?	Life Science	Structure of Plants Petal Root Absorbent Hairs	- “The first item on the list was petals. “Okay,” thought Erdem. “I know what petals are. Those leaves on top of flowers. But I can’t see any flowers.”	-	-
9.Clever Trevor	Physical-Energy Sciences	Lever Force Balance point	- “The balance of this old seesaw is upset when we change places. The rock stays on the ground, while I’m in the air.”	-	-
10.It Came From Outer Space	Space Sciences	Meteorite space waste Atmosphere Meteor Spacecraft rock fragment Thunder Raining Binoculars World Orbit Rocket	-“When meteorites hit the earth, they have a melted layer on them. So their surface is pitch black.”	NASA	-

		Flammable gases			
11.Monster Bug	Physical-Energy Sciences	Shadows Light	- "I tried to look between the boxes. There was a huge shadow moving on the wall. It was coming towards us!"	-	-
12.A Slimy Story	Life Science	Earthworms Mucus	- Pointing to the ground, he said, "You were about to step on that earthworm!" "Absolutely not!" I said.	-	-
13.What's That Sound?	Physical-Energy Sciences	Sound Vibration Sound wave	- "I was about to fall asleep when I heard the rumbling sound. Thunder. The window rattled."	-	-
14.Hocus Focus	Physical-Energy Sciences	Optical Myopic Hypermetropic Glasses Each	- "Okay Cem, you're myopic," said Dr. Deniz." "I'm hypermetropic," said Ada.	Doctor	-
15.The Nose Knows	Life Science	Sense of smell Sense of Taste Cold Gas Decay	- "I can't smell anything," said Cenk. "Because you have a cold," said Aykut."		
16. A Moldy Mystery	Life Science	Mold Mushroom Preservative	- "On the Fun with Fungi website, it says that mold grows faster in dark and damp places," I said to Beste. - "Under the bed is dark," she said. But not damp."	--	
17.Bubble Trouble	Physical-Energy Sciences	Bubbles	- "Senem put a piece of gum in her mouth. She chewed and chewed. Then she opened her mouth a little and blew a perfect pink bubble. I tried."	-	-

18.Butterfly Fever	Life Science	Migration	-“Monarch butterflies are not the only species of butterfly that migrates. However, they travel the farthest!”	Scientist
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When the analysis of the scientific content of the informational children’s picture books in the TÜBİTAK publications’ Science Solves It series is examined in Table 1, it is seen that 61.11% (f=11) of the scientific concepts mentioned in the content of the books are in the field of life sciences, 45.46% (f=5) are in physical-energy sciences, and 18.18% (f=2) are in space sciences according to science standards. In the books on life sciences according to science standards, 31 scientific concepts are mentioned, and the scientific concepts mentioned in the books are; dinosaur, mammoth, camouflage in animals, chameleon, polar bear, snowshoe hare, snowy owl, ants, colony, animal tracks, raccoon, nutrition, egg, beak, water algae, plant structure, petal, root, absorbing hairs, earthworms, mucus, sense of smell, sense of taste, colds, gas, decay, mold, fungus, preservative and migration. In the books on physical-energy sciences according to science standards, 14 scientific concepts are mentioned, and the scientific concepts mentioned in the books are; levers, force, balance point, light, shadow, sound, vibration, sound wave, optics, myopia, hyperopia, glasses, beaker and bubbles. In the books on space sciences according to science standards, 14 scientific concepts are mentioned, and the scientific concepts mentioned in the books are; tidal meteorite, space debris, atmosphere, meteor, spacecraft, rock fragment, thunder, rain, binoculars, earth, orbit, rocket and combustible gases. In Table 1, it is seen that in the content of the informational children’s picture books in the TÜBİTAK publications’ Science Solves It series, only 4 books (22.22%) support the image of a scientist by using concepts such as paleontologist, NASA employee, doctor and scientist. In the TÜBİTAK publications’ Science Solves It series of informational children’s picture books, it is seen that only 1 book (5.56%) provides information to children about the history of science, specifically that “mammoths lived during the ice age.” The analysis of the informational children’s picture books in the TÜBİTAK publications’ Science Solves It series in terms of scientific process skills is shown in Table 2.

Table 2

Analysis of the Informational Children’s Picture Books in the TUBITAK Publications’ Science Solves This Series in Terms of Scientific Process Skills

Books	Scientific Process Skills																
	Basic Process Skills							Causal Processes					Experimental Processes				
	T1	T2	T3	T4	T5	T6	T7	N1	N2	N3	N4	N5	D1	D2	D3	D4	D5
Buried in Backyard	+	+	-	+	+	+	-	+	-	-	-	+	-	-	-	-	-
Almost Invisible Irene	+	-	-	-	+	-	-	+	+	-	-	-	-	-	+	-	-
Ant Attack	+	+	-	-	+	-	-	+	+	+	-	+	-	-	+	+	+
Bears on the Brain	-	+	-	+	+	-	-	+	-	-	-	+	+	+	+	-	+
Picky Peggy	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-
Creeping Tide	+	+	-	-	+	-	-	+	+	-	-	-	-	-	-	-	-
The Green Dog	+	+	-	-	+	-	+	+	+	-	+	+	+	-	+	-	-
What Homework?	+	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-
Clever Trevor	+	-	-	-	+	-	-	+	+	-	+	+	-	+	+	-	-
It Came From Outer Space	+	+	-	-	+	-	-	+	-	-	-	-	-	-	-	-	+
Monster Bug	+	+	-	-	+	-	+	-	+	-	+	+	-	-	-	-	-
A Slimy Story	+	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-

What's That Sound?	+	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-
Hocus Focus	+	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-
The Nose Knows	+	+	-	-	+	-	+	-	-	-	+	+	-	-	-	-	-
A Moldy Mystery	+	+	-	-	+	-	+	+	+	+	+	+	+	+	+	+	+
Bubble Trouble	+	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Butterfly Fever	+	+	-	-	+	-	+	+	+	-	+	+	-	-	-	-	-
Total	1	1	0	2	1	1	7	1	1	2	6	9	3	4	8	2	4
	7	1			8			1	2								
Percentage	3	1	0	4	3	2	1	2	3	5	1	2	1	1	3	9	1
	0	9			2		3	8	0		5	2	4	9	9		9
Classification Total	56			40					21								
Classification Percentage	%47,86			%34,19					%17,95								

T1: Making Observations; T2: Comparing; T3: Classifying; T4: Measuring; T5: Communicating; T6: Using Number/Space Relationships; T7: Collecting and Recording Data; N1: Predicting; N2: Inferring; N3: Identifying Variables; N4: Interpreting Data; N5: Drawing Conclusions; D1: Formulating Hypotheses; D2: Using Data and Creating Models; D3: Conducting Experiments; D4: Manipulating and Controlling Variables; D5: Making Decisions

When Table 2 is examined, it is seen that 47.86% (f=56) of the informational children's picture books in the TÜBİTAK publications' Science Solves It series contain basic process skills, 34.19% (f=40) contain causal process skills and 17.95% (f=21) contain experimental process skills in terms of scientific process skills. Within the basic process skills, it is seen that 32% (f=18) have communication skills, 30% (f=17) have observation skills, 19% (f=11) have

comparison skills, 13% (f=7) have data collection and recording skills, 4% (f=2) have measurement skills and 2% (f=1) have the ability to use number/space relationships. It is seen that the classification skill among the basic process skills is not included in the content of the books. Within the causal process skills, it is seen that 30% (f=12) have inference skills, 28% (f=11) have prediction skills, 22% (f=9) have conclusion drawing skills, 15% (f=6) have data interpretation skills and 5% (f=2) have variable identification skills. Within the experimental process skills, it is seen that 39% (f=8) have experiment conducting skills, 19% (f=4) have data usage and 19% (f=4) have decision making skills, 14% (f=4) have hypothesis formulation skills and 9% (f=2) have variable manipulation and control skills.

Discussion

As a result of the research, it has been observed that the informational children's picture books in the Science Solves It series published by TUBITAK were mostly prepared within the framework of life science standards. However, they were found to be insufficient in terms of imparting the image of a scientist to preschool children and presenting information on the history of science. In particular, the failure to present the image of a scientist in a manner appropriate to the content of the books is a significant deficiency. For example, in the book *Buried in Backyard*, instead of mentioning scientists who study dinosaur and mammoth bones as paleontologists and archaeologists, they are referred to as "fossil scientists", which is seen as a deficiency. The correct use of scientific concepts is also important in supporting the image of a scientist in children from an early age. Similarly, it is thought that in all books related to life science, scientists such as biologists, zoologists (ethologists), botanists, and phytologists can be introduced to children as scientists, as well as physicists in the field of Physical-Energy Sciences, and astronomers, sky scientists, and astronauts in the field of Space Sciences. Saçkes, Trundle and Flevares (2009) argue that using children's literature to introduce scientific concepts at an early age is a unique opportunity for children. In addition, it is known that exposing children to scientific dialogues through picture books with scientific content in children's literature also improves children's scientific vocabulary (Gozales et al., 2011; Leung, 2008; Okyay & Kandır, 2019). It is considered important to address the lack of support for the image of a scientist and the provision of information to educate children about the history of science in informational children's picture books, whose importance is so evident in this research. Because it has been observed that children who have the necessary opportunities to

engage with science from an early age develop excitement and desire for science (Crowther et al., 2005; Akman et al., 2003; Guler & Akman, 2006). Informational children's picture books play an important role in providing children with the necessary opportunities to engage with science. Especially as stated in the research conducted by Hong and Diamond (2012), it has been observed that having more scientific concepts and scientific vocabulary has a positive effect on children's scientific problem-solving skills. When the scientific dialogues in which the scientific concepts contained in the informational children's picture books in the Science Solves It series published by TÜBİTAK were examined, it was determined that their use in terms of scientific usage was correct and did not have any usage that could create conceptual confusion in children. However, when choosing such books, care should be taken to ensure that their narrative languages do not contain misconceptions of science concepts (Short, 2010; Trundle & Troland, 2005).

When the informational children's picture books in the Science Solves It series published by TUBITAK, which were examined within the scope of the research, were analyzed in terms of scientific process skills, it was observed that the books contained the most basic process skills, followed by causal process skills and the least experimental process skills. Within the basic process skills, it was observed that the books contained the most communication skills and, in order, observation skills, comparison skills, data collection and recording skills, measurement skills and the least use of number/space relationships. As a result of the research, it was observed that communication and observation skills were the most common in the books. This result is consistent with the literature that suggests that observation, one of the scientific process skills, can be developed through children's literature (Cetin et al., 2012). However, in a study conducted by Bicer et al. (2021), it was observed that observation skill was less common in picture books for children. As a result of the research, although measurement and use of number/space relationships skills were very few, they were among the most common skills in the picture books for children examined in the studies conducted by Bicer et al. (2021) and Ceylan (2012). At this point, contrary to Aydoğdu (2014)'s view that books have a very rich content on measurement skill, which is one of the prerequisites for reaching a conclusion using scientific process skills, it was observed that the least common scientific process skills in informational children's picture books in the Science Solves It series published by TUBITAK were measurement and use of number/space relationships. The result of the low use of number

relationships skill is also supported by the research conducted by Veziroglu & Gonen (2012). In this research, where 250 picture books for children in Turkey were examined in terms of the Preschool Education Program, it was found that picture books for children had very few expressions on counting. Contrary to the low presence of spatial relationships in the research, it was observed that picture books for children in the research conducted by Veziroglu and Gonen (2012) and Bicer, Basaran and Gungor Aytar (2021) had a lot of expressions on spatial relationships. In this research, it was observed that the classification skill, one of the basic process skills, was not included in the content of the books at all. In parallel with this, it is seen in the literature that little space is given to classification skill in picture books for children. Within the causal process skills, it was observed that the books contained the most inference skills, followed by prediction skills, conclusion drawing skills, data interpretation skills and the least identification of variables. Although prediction skill is one of the most common skills in the books, there are results in the literature showing that prediction skill is less common in picture books for children (Bingol & Unal, 2019). Within the experimental process skills, it was observed that the books contained the most experiment skills, followed by data usage skills, decision-making skills, hypothesis-forming skills and the least changing and controlling variables skills.

Conclusion

As a result of the research, although some scientific process skills were found to be less common in picture books for children, it was observed that these books could be beneficial for children in terms of supporting the development of scientific content, scientific concepts and the image of a scientist. In her research, Elkey (2017) stated that observing the life cycle of a silkworm through these books by a Parsons and Bryant (2016), preschool child is important in terms of acquiring and developing scientific process skills. Picture books for children provide many conveniences in terms of time, space and materials to support children's scientific process skills and are therefore preferred by teachers (Karamustafaoglu & Kandaz, 2006).

Recommendations

At this point, as a result of the research, it is thought that it is important to ensure that preschool teachers are more familiar with informational children's picture books that present scientific

content so intensively and in a way that is suitable for children's level and to create platforms where teachers can easily access these types of books.

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