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Interdisciplinary Science and Social Studies Education in The Context of Five Weeks in a Balloon

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ABSTRACT This study aims to determine the usability of the book 'Five Weeks in a Balloon' authored by Jules Verne, as a context for interdisciplinary teaching of fourth-grade science and social studies courses. As a document review, the book was analyzed based on the Science and Social Studies Curricula/Turkey-2018. The book was associated with all learning areas of the Science Curriculum and five of the seven learning areas of the Social Studies Curriculum. It was determined first the association between the two curricula and the book, then starting points for planning appropriate activities for multidisciplinary, interdisciplinary, and transdisciplinary teaching. As a result, the book can use as a context for fourth-grade science and social studies courses. Also be used in multidisciplinary, interdisciplinary, and transdisciplinary teaching to integrate science and social studies courses. Teachers and researchers can carry out various studies by designing interdisciplinary environments by benefiting from the study results.

Keywords Interdisciplinary Approach, Jules Verne's Book, Social Studies Education

1. INTRODUCTION

The effort to keep up with the developments brought by science and technology in the education policies, reforms, or programs of various countries is at the center of innovations, and it emphasizes that a single discipline-specific knowledge is not sufficient to solve the problems encountered in the 21st century (Hacıoğlu, Yamak & Kavak, 2016). Knowledge and skills from many disciplines need to run integrated to solve today's problems. Although the emphasis on interdisciplinary education started with Dewey in 1929, for science education research, it is still essential (Liu & Wang, 2019). With the globalization of science education and the increase in disciplinary teaching research, the emphasis on interdisciplinary education is increasing day by day (Orion, 2019), with the emergence. The emergence of experts in science, technology, engineering, and mathematics (STEM) disciplines. That may indicate that interdisciplinarity in education is still not as desired, and the effort continues. Another indicator of this is that interdisciplinary education still has not reached its goal since STEM education practices cannot establish a relationship with the social and cultural context of the students (Zeidler, 2016). Disciplinarity consists of specialized knowledge, unity of a standard set of concepts, specialized methods, and organized people (Liu & Wang, 2019). But it makes no sense to divide subjects into disciplines in schools as they are not divided into disciplines in real-life as well (Carr, Loucks & Blöschl, 2018; Czerniak, Weber, Sandmann, & Ahern, 1999). Science teaching is related to real-life as a natural and pervasive consequence of living in a world rich in science (Roth & Calabrese-Barton, 2004). Therefore, it would be beneficial to use an interdisciplinary approach during teaching.

The interdisciplinary approach can establish a real-life context for students to make learning more meaningful and effective. It is to organize a common context/theme/subject with different courses/disciplines and to organize the learning environment to reach the teaching objectives by working with the knowledge, skills, and methods specific to these courses/disciplines (Drake & Burns, 2004; Grady, 1994; İşler, 2004; Jacobs, 1989). The purpose of such an application may be to teach the context/theme/subject or to gained discipline-specific knowledge, skills, and methods. These are considered different ways of interdisciplinary teaching (Smith, 2006).

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Teachers can design and implement effective learning environments in collaboration by recognizing the characteristics and needs of different disciplines (Akerson & Flanigan, 2000; Yıldırım, 1996). In this direction, it seems that America, Europe, and the Far East countries put the interdisciplinary approach at the center of their educational reforms (Ministry of National Education [MoNE]-Innovative Educational Technologies, 2016). In recent years, this situation has been encountered as science, technology, society and environment approach, context-based approach, or STEM education.

21st-century curricula are carried out in Turkey. The curricula for 2018, as the last change, point out the importance of establishing interdisciplinary relationships in courses. However, international exams show that the Turkish education system has problems in discipline-specific skills and reading comprehension skills required for such an education (MoNE-General Directorate of Assessment and Examination Services, 2016a). In this context, it is essential to improve students' skills to understand what they read and the knowledge of the discipline and establish relationships with other disciplines and utilize different disciplines while solving various problems. From a different viewpoint, TIMSS-2015 results show that students' achievements increase as the number of educational opportunities/sources at home increases. One of these sources is defined as children's books (MoNE-General Directorate of Assessment and Examination Services, 2016b). That also shows the importance of reading activities for students' achievements in different disciplines. Indeed, while learning about other disciplines in language arts classes (Akerson & Flanigan, 2000; Jacobs, 1989) can improve students' reading comprehension skills with science (Şahin & Hacıoğlu, 2010) or interdisciplinary science education (Johnston, 2018).

Literary works can provide students' awareness of real-life problems or be a guide to solving these problems (Forgan, 2003; Fredericks, 2007; Sills-Briegel & Camp, 2001). Also, they can be used as an example or a context to enable students to gain knowledge, skills, and literacy specific to the discipline during courses where subjects from different disciplines are treated (Fang & Coatoam, 2013; Gelzheiser, Hallgren-Flynn, Connors & Scanlon 2014; Harmon, Wood, & Stover 2012; Orçan & Kandil-İngeç, 2016). These practices were also suggested (Thomsen, 1977) and tried (Kleiman, 1991; Maria & Junge, 1993) about 30-40 years ago. It continues to be recommended and tested shortly. Lesson plans for science teaching prepared by NASA (2015) using literary works and studies examining the relationship between the acquisitions of the physics curriculum and Jules Verne's various literary works (Aygün & Şahin, 2020) are examples of this. That is not just for science education. At the same time, there are similar suggestions (Sömen, 2021) and applications (Akdemir & Saban, 2020; Akkocaoğlu-Çayır, 2015; Ceylan, 2017; Lone, 2017; Öztürk, 2011; Turan, 2015) in social studies education. Literary works can be applied in both science and social studies education, considering both suggestions and practice.

Science and social studies have interdisciplinary nature, involve interdisciplinary applications, and welcomes the integration of other disciplines as inquiry (The National Council for the Social Studies [NCSS], 2015; Next Generation Science Standards [NGSS], 2015). Social issues play an integrative role in both science and social studies. Milto, Portsmore, Watkins, McCormick & Hynes (2020) asked students to carry out the engineering design process to find solutions to the problems in the novels in their projects, which they expressed as novel engineering. In this way, they integrated the engineering discipline, a vital STEM education, into K-8 classes. At the same time, their literacy improves as students need to understand the problem statement in the novel by reading, writing, and discussing. This problem statement allows entering into engineering design through literature. Authors suggest that teachers can adapt texts for the English language arts or social studies curriculum. This suggestion may be another indication for integrating science, social studies, and other disciplines or other core concepts in an engineering context.

Positive effects on students' motivation to learn and be compatible with the curriculum's acquisitions can accept as criteria in selecting literary works to use in courses (Krey, 1998; McGowan & Guzzetti, 1991; McGowan, Erickson, & Neufeld, 1996). However, teachers stated that they had difficulty in finding literary works that meet these criteria (Ünlü, 2016; Sevinç, 2018; Sömen & Metin-Göksu, 2017; Sömen, 2021). Also, a study conducted with elementary school teachers found that some of the teachers did not have enough knowledge about children's books and interdisciplinary teaching (Öztürk-Yılmaz, 2019). That suggests that teachers need to know how to use children's books in teaching and theoretical knowledge for this kind of practice.

1.1. Theoretical Framework

Multidisciplinary, interdisciplinary, and transdisciplinary applications are more widely used in the literature (Drake & Burns, 2004; Grady, 1994; Jacobs, 1989). Besides, it is also possible to encounter different applications such as cross-disciplinary and pluri-disciplinary applications, shaping according to the purpose and student group (Jacobs, 1989). It can be assumed that three approaches are the basic ones for interdisciplinary teaching. Multidisciplinary approach in which a context/theme/topic is treated in different courses/ disciplines and the courses are taught independently (Drake & Burns, 2004). Teachers can treat topics independently of each other in selected themes, based on the

multidisciplinary approach definitions of Grady (1994) and Drake & Burns (2004).

The interdisciplinary approach uses knowledge and methods from multiple disciplines without discrimination to thoroughly learn a context/theme/topic (Grady, 1994; Tress, Tress, & Fry, 2005; 2007). In the interdisciplinary approach, the goal may be to teach a theme. In such an application, the emphasis is on the subject chosen as context rather than course acquisitions. The teacher eliminates the boundaries between the courses and enables the students to reach the acquisitions. In this case, students should think the theme is treated instead of individually taught science and science courses. Students can expect to establish cross-correlations between knowledge and methods of different courses through the situation or plot they encounter (Grady, 1994; Nargund-Joshi & Liu, 2013; Tress, Tress, & Fry, 2005; 2007).

The transdisciplinary approach manages the process of seeking answers to real-world problems (Walter et al., as cited in Stock & Burton, 2011). That is its main difference from the interdisciplinary approach. For this, disciplines should not be considered individually but as an integrated one (McClam & Flores-Scott, 2012). Therefore, it is necessary to think like experts or scientists from relevant disciplines (Tress, Tress, & Fry, 2006). In this process, students expect to think like a scientist, a social scientist, an engineer, and a mathematician at the same time while solving real-world problems, just like Pythagoras. Such a process may remain surreal for today's problems; therefore, students must collaborate with stakeholders (field experts/professionals, institutions, foundations, associations, etc.).

1.2 The Objective and Research Questions

Elementary school teachers have to teach science and social studies subjects to their students and instill a love of reading. However, they can manage interdisciplinary teaching by seeing the teaching as a whole rather than individually handling each stage. Thus, literary works can take place in all courses, going beyond the love of reading or language and literature teaching.

It is beneficial to investigate Jules Verne's books in teaching by an interdisciplinary approach in elementary schools. Because Jules Verne, who was second in the world ranking between 1979 and 2017 in the Index Translationum (UNESCO, 2017), is a widely read author. Besides, he presents his predictions about developments in science and technology as science fiction in his books (Yüksel, 2016). He inspires European industry/technology with various inventions, and he also touches on issues such as schooling and urbanism (Türkmen, 2008). From this point of view, the usability of Jules Verne's books as a context in interdisciplinary teaching in elementary schools, especially in science and social studies courses, should be examined. Thus, a literary work that can be used in interdisciplinary teaching and usable for teachers can be determined. Teachers can use literary works in interdisciplinary teaching based on their inferences from this study. This study can also bring a new perspective to textbook authors or experts who develop curricula. The author's book 'Five Weeks in a Balloon' was also present as a movie (IMDb, 2021) deemed worthy of examination, considering that it could provide visual material support in learning-teaching activities.

Considering all these, the research question (RQ) of this study is: Can the book 'Five Weeks in a Balloon' be used in fourth-grade science and social studies teaching with an interdisciplinary approach? For this question, answers were sought for the following sub-research questions:

RQ1: Can the book 'Five Weeks in a Balloon' be associated with the acquisitions in science and social studies curricula?

RQ1-1: Can the book 'Five Weeks in a Balloon' be associated with the science curriculum?

RQ1-2: Can the book 'Five Weeks in a Balloon' be associated with the social studies curriculum?

RQ2: Can the associations between the book 'Five Weeks in a Balloon' and the science and social studies curricula be integrated into interdisciplinary teaching types?

Content integration or context integration provide to integrate the disciplines (Moore et al., 2014). For this reason, in this study, it is necessary to determine which events or situations in the book can be a part of the context and which social study or science acquisitions can be associated with these contexts. For this, the content of the book and the acquisitions in the curricula associated. Later, it discussed how the book 'Five Weeks in a Balloon' could use in interdisciplinary education.

2. METHOD

This research, conducted as qualitative research, examines the book 'Five Weeks in a Balloon' according to the acquisitions of the fourth grade Science and Social Studies Curricula (MoNE, 2018a; MoNE, 2018b). Document review carries out in five stages as follows (Forster; as cited in Yıldırım & Şimşek, 2013).

(1) Access to the document: The various versions of the book published in Turkish by different publishers were reached.

(2) Checking for authenticity: It found that none of the accessible books is a full-text translation, and the language from which the translation is not specified in the books. Therefore, the hardcopy 120-page book 'Five Weeks in a Balloon' (Verne, 2017) is selected as the document of the study.

(3) Understanding the documents: When the selected book was read by one of the researchers, it was determined that it could be associated with the curricula.

(4) Analyzing the data: For RQ1, a deductive content analysis was carried out within the framework of the fourth-grade acquisitions in the Science and Social Studies Curricula. Thus, the association of the book with the

acquisitions has been revealed. This association is presented in a separate table for both curricula. It is observed that some acquisitions are related to the own geographical location or immediate circle of students. This type of acquisition shows that the relevant part of the book does not precisely match the acquisition. This book takes as a context for teaching, so an exact fit does not expect in this study. For example, let's explain the acquisition of *"Puts the major events of their life in chronological order."* This acquisition in the Social Studies Curriculum is paired with a chronological recount of critical events (his parents' death in an accident, military service) in Dr. Fergusson's life. The acquisition *"Explains the events that take place as a result of the movements of the Earth."* in the Science Curriculum was associated with the events such as early beams, sunrise, first sunlight of the day, getting dark, fall of darkness, and visibility of the moon encountered in the story. Different experts analyze the data to ensure the study's credibility, which refers to the results' relevance to the purpose of the study, and its transferability, which refers to the adaptation of the study to different situations (Merriam, 2013). So that the study can be consistent and confirmable, the data analysis process explains in detail, the data analysis repeats repeatedly, and the results were created by comparing the analyses made by two researchers. Data was built on the data of Durkan, Hacıoğlu, Aygün, & Ceylan (2017). After authors' preliminary study curricula in Turkey have been updated. To update the acquisitions of the association in this study, the first researcher compared the acquisitions in the new curricula MoNE (2018a, 2018b) with the elder one. Because all of the acquisitions are not matched, the book's content was analyzed again according to the new program by the second and third researchers of the study. They compared the document content again to establish an acquisition-book content relation. Opinion of the third researcher was taken for the associations on which no consensus could be reached between two researchers, and the discussions were closed with a consensus of all three researchers.

In the descriptive analysis for RQ2, interdisciplinary associations are made by the researchers using the analyzes of RQ1. The first three researchers of this study previously took part in a research project in which interdisciplinary teaching processes were carried out. The first and third researchers are experts in context-based teaching, and the second researcher is an expert on interdisciplinary science and STEM education. The second researcher first created interdisciplinary associations and then finalized with extensive discussions with the inclusion of the other two researchers. The fourth researcher is a teacher who is an expert in the field of elementary education and has teaching experience in the fourth grade, evaluated interdisciplinary relations in terms of their feasibility.

(5) Using the data: Results related to RQ1 were determined using the tables. Since the events/facts or situations that take place in the book occur in a flow, they are sometimes explained with multiple pages. For example, weather events and their effects detail in various locations and events during the five-week journey. For this reason, the events/facts or situations in the book were coded rather than quoted directly. The examined book is in Turkish. Direct quotations presented in the findings have been translated into English. The findings of RQ1 use and sample applications present to determine the book's usability in interdisciplinary teaching for RQ2.

3. RESULT AND DISCUSSION

The results present in sub-headings following the sub-research questions.

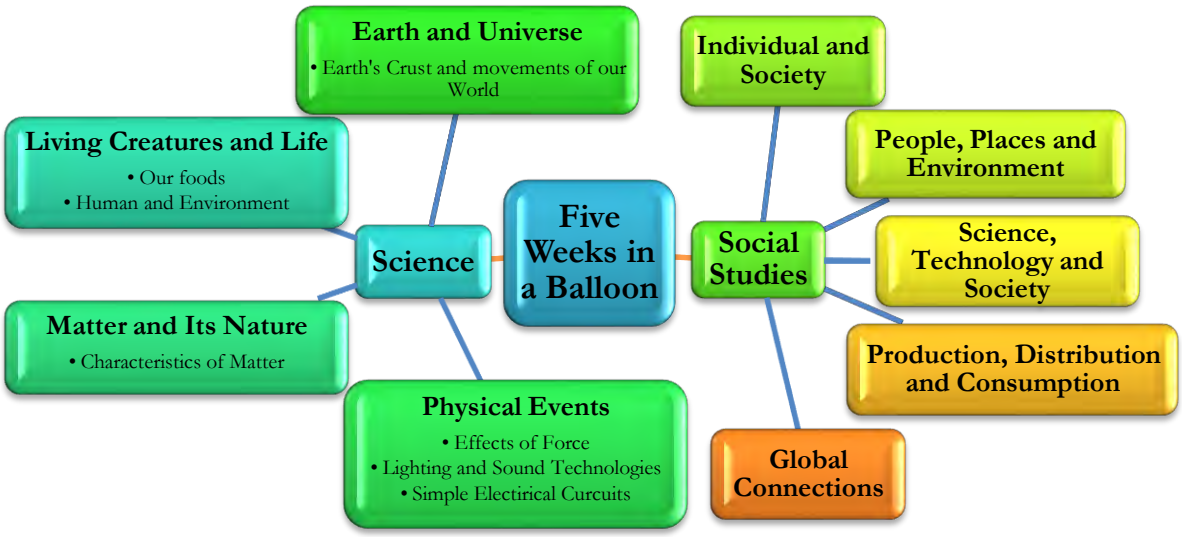

Figure 1 Learning/subject areas where the book 'Five Weeks in a Balloon' is associated with the curricula

Table 1 The relation of the fourth grade science acquisitions with the book

The Science Curriculum		The Book (Five Weeks in a Balloon)	
Learning Area	**Acquisition (S.4. …)**	**Content Regarding the Acquisition**	**Page no**
EU/ECMV	1.2.2. Explains the events that take place as a result of the movements of the world.	Early beams, sunrise, first sunlight of the day, getting dark, fall of darkness, and visibility of the moon	28, 34, 35, 44, 47, 81, 88
LCL/F	2.1.1. Explains the relationship between life and food contents.	Water, tea, sugar, salted meat, rusks, biscuits as nutritious foods; Water supply from the lake	21, 22, 43
	2.1.2. Deduces that all foods contain water and minerals.	Emphasis on the importance of water, water in cactus, efforts to find water	73, 79, 80, 81, 82, 85, 94
	2.1.4. Associates human health with a balanced diet.	The milk in Kafuro towns causes fatness - everyone is fat. Living conditions - they eat less because they don't move much.	48, 61
PE/EF	3.1.1. Performs experiments on the effects of force, including making objects move and changing their forms.	Movement of the balloon with the effect of the wind, airflow, springs, balloon gas, crawl stroke, swimming	21, 27, 31, 34
	3.2.1. Recognizes a magnet and discovers its poles.	To find a direction by using the poles of a compass, which is a magnet itself	36, 42, 96
MN/CM	4.1.1. Uses own five sense organs to explain the essential characteristics of the matter.	Desert heat, compass, balloon take-off, experience after jumping into the water, falling off the balloon and its basket into the river	19, 21, 97, 108, 112, 113
	4.3.1. Compares the basic properties of the states of matter. 4.3.2. Gives examples of different states of a matter. 4.4.1. Designs experiments for the heating and cooling of matters.	Fog, cloud, gas used in the balloon, temperature, thermometer	19, 27, 30, 34, 89
PE/LST	5.1.1. Compares the lighting tools used in the past and today. 5.1.2. Design lighting tools that can use in the future. 5.2.1. Makes research on proper lighting. 5.3.1. Questions the reasons for light pollution. 5.3.2. Explains the adverse effects of light pollution on natural life and observation of celestial bodies.	Transient blindness causes by emitting light from coal to rescue the captive from cannibals	73, 74
LCL/HE	6.1.1. Cares to behave economically in the use of resources.	Search for water-Economic use of foods; Taking a break to save fuel in adverse conditions	79
PE/SEC	7.1.1. Recognizes the circuit elements that make up a simple electric circuit as well as their functions. 7.1.2. Builds a functioning electric circuit. 7.1.3. Knows that electrical switches and cables at home and school are circuit elements.	Batteries, cables, emitting light from coal to rescue the captive from cannibals	21, 73, 74

3.1. Comparison of the Fourth Grade Acquisitions of the Science and Social Studies Curricula with the Content of the Book

This study examined the book 'Five Weeks in a Balloon' and the fourth-grade acquisitions of Social Studies and Science Curricula to establish a relation between the book and both curricula. This relation is present in Figure 1. The book associate with both curricula in different learning/subject areas. This relation describes in detail below.

3.1.1. Comparison of the Fourth Grade Acquisitions of the Science Curriculum with the Content of the Book

The Science Curriculum for the fourth-grade includes four subject areas and seven modules (46 acquisitions in total), namely 'Earth's Crust and Movements of our World' (EU/ECMW) in the subject area 'Earth and the Universe'; 'Our Foods' (LCL/F), and 'Human and Environment' (LCL/HE) in the subject area 'Living Creatures and Life'; 'Characteristics of Matter' (MN/CM) in the subject area 'Matter and Its Nature'; 'Effects of Force' (PE/EF), 'Lighting and Sound Technologies' (PE/LST), and 'Simple Electrical Circuits' (PE/SEC) in the subject area 'Physical Events'. The cases to use the content of 'Five Weeks in a Balloon' as a context in teaching science were examined and presented in Figure 2

Figure 2 shows that the book's content can use as a context in all learning areas and modules of the Science Curriculum for the fourth grade. Table 1 shows the

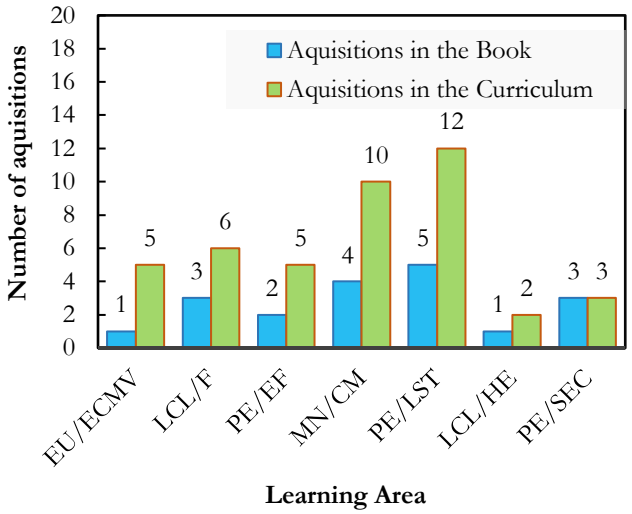

Figure 2 The distribution of the associated acquisitions with the book according to learning areas in the Science Curriculum

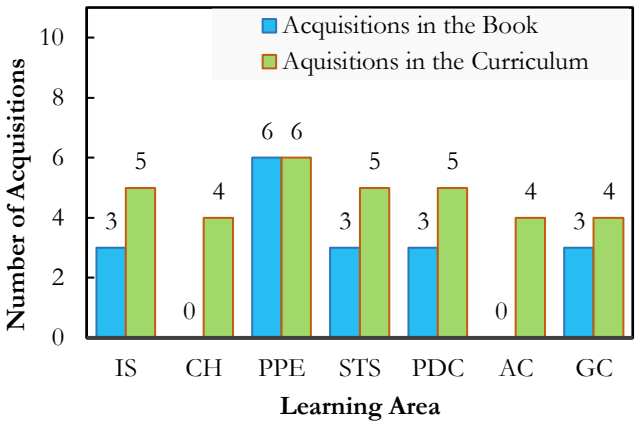

Figure 3 The distribution of the associated acquisitions with the book according to learning areas in the Social Studies Curriculum

acquisitions that can form a context concerning these learning areas and modules.

According to Table 1, most of the acquisitions listed in the curriculum can be associated with multiple subjects/events in the book. Below examples are described showing the emergence of such associations as presented with the page numbers in the table:

"S.4.1.2.2. Explains the events that take place as a result of the movements of the world." is described in the curriculum as follows: *"…The position of the Sun changes during the day due to the rotation of the Earth is discussed… Formation of day and night is discussed."*. Expressions such as early beams and the darkness of the night are frequently seen in the book: *"…The next morning when the sun starts to show its face from behind the eastern hills… In the evening… He was observing the areas he could see in the light moonlight… As night fell, they anchored…."*

"S.4.2.1.1. Explains the relationship between the life and food contents." is described in the curriculum as follows: "*Emphasis is laid on proteins, carbohydrates, fats, vitamins, water, and minerals without getting into their detailed structures. Types of vitamins are not mentioned"*. Many chapters of the book mention importance of water and healthy nutrition, with example foods:

> *"…Also, lightweight, nutritious water, tea, sugar, salted meat, rusks, biscuits were placed in the basket... Our water … is running out, sir... We must continue the flight until we find the water when we see a lake ahead... Let's get our water out of that lake..."*

"S.4.2.1.4. Associates human health with a balanced diet." is described in the curriculum as follows: "*The relationship between obesity and dietary habits is highlighted. …*". In the book, the sentence *"Although the travelers were eating three meals a day as in their normal lives, they were paying attention to eat less since they were not moving much and could not adequately digest."* mentions the daily diet and the reasons why the fat people in Kafuro Town are fat as well as the properties of the foods: *"… As far as I can see, almost all of the townspeople were fat. It was exciting. That was Kafuro Town. The milk produced in this region causes obesity..."*

Related to *"S.4.3.1.1. Performs experiments on the effects of force, which include making objects move and changing their forms."*, in the book discusses the purposes of the springs around the basket regarding the redesigned balloon and provides information about the effect of the wind on the movement of the balloon and mentions that the ascending force causes tension in the ropes after the balloons are filled with gas. Related to "*S.4.3.2.1. Recognizes a magnet and discovers its poles."* compass usage frequently takes place in the book. Poles of the compass help finding a direction: *"… The compass is solid; we are constantly flying northeast... Could the direction of the balloon have deviated? ... "*

"S.4.4.1.1. Uses own five sense organs to explain the basic characteristics of the matter." is described in the curriculum as follows: "*Students use their sense organs during the subjects treating the features such as buoyancy and sinking, water absorption and non-absorption, magnetic attractability, etc. which characterize the matter."*. For example, the book talks about Joe's buoyancy after jumping from the balloon into the water. The balloon's basket is breaking off, falling into the rivers, and floating, but the balloon itself is sinking into the water.

"*S.4.7.1.1. Recognizes the circuit elements that make up a simple electric circuit as well as their functions.", "S.4.7.1.2. Builds a functioning electric circuit.",* and *"S.4.7.1.3. Knows that electrical switches and cables at home and school are circuit elements.*" are described in the curriculum as follows: "*Battery, light bulb, cable, and switch introduced as circuit elements.", "The student is requested to build a circuit using a light bulb, a battery, and a switch."* and "*It emphasizes that there are connection cables, which pass through the wall, between the light switches and the lamps.".* Besides the batteries and cables provided to use when needed, the book also mentions a circuit prepared for obtaining bright light.

Table 2 The relation of the fourth grade social studies acquisitions with the book

The Social Studies Curriculum		The Book (Five Weeks in a Balloon)	
Learning Area	**Acquisition (SS.4. …)**	**Content Regarding the Acquisition**	**Page no**
IS	1.2. Puts the significant events of their life in chronological order.	Significant events in Dr. Fergusson's life	5, 6, 7
	1.4. Puts themself in the shoes of other individuals who have different characteristics.	Descriptions of individuals, attributive adjectives	5, 16, 75
	1.5. Respects the different characteristics of other individuals.	Descriptions of individuals and attributive adjectives; his assistant does not want to join the journey, voting, discussion platforms	5, 6, 8, 10, 16, 75, 100
PPE	3.1. Makes inferences about the location of any place around.	Positioning, map, compass	10, 17, 32, 36, 42, 45, 79, 95, 96, 112
	3.2. Draws sketches of the places use in own daily life.	They go down to the river while they should have gone down to the other side of the river.	112, 113
	3.3. Distinguishes the natural and human elements in the environment lives in.	Lake, going to the island (such as the presence of 4 trees, two boats)	43, 54
	3.4. Observes the weather events occurring around and transfers own findings to pictorial charts.	Fog, Storm, Wind, Sun	28, 36, 42, 47, 61, 79, 87, 89, 90, 91, 102
	3.5. Makes inferences about the place's geographical formations and population characteristics, where it lives, and its surroundings.	Cultural and geographical structure of Africa, settlements	8, 12, 17, 24, 32, 33, 46, 89, 95, 105, 110
	3.6. Makes necessary preparations for natural disasters.	Compass, binoculars, barometer, stopwatch, thermometer, batteries, cables, strings, water, tea, sugar, salted meat, rusks, biscuits Water supply from the lake	19, 21, 43
STS	4.1. Categorizes the technological products according to their area.	Compass, binoculars, barometer, stopwatch, thermometer, batteries, cables	19, 21, 36, 42, 87, 89, 90, 96
	4.2. Compares the past and present uses of technological products.	Andrea Debono arrives at the snowy mountains by walking, but the book characters arrive by a balloon.	57
	4.4. Develops ideas for designing typical products based on the needs around.	The character changes the balloon design in their way (silk fabric), and they emit light from coal to save the captive from cannibals.	19, 21, 73
PDC	5.1. Distinguishes own desires and needs and makes conscious choices between them.	We set the weapons, throwing gold bars from the balloon down into the lake to prevent the balloon from falling.	29, 97
	5.2. Recognizes the significant economic activities in own family and immediate circle.	Doctor, maid, captain, priest, soldier, lieutenant, association membership, consul, scientist, employer	5, 6, 7, 8, 10, 11, 23, 76, 113
	5.5. Uses the resources around without wasting.	Setting the weapons, use of the remaining water	29
GC	7.1. Can introduce various countries in the world.	Scotland, England, Switzerland, Africa, Mediterranean	7, 11, 14, 19, 32
	7.3. Compares the cultural elements of different countries with the cultural elements of our country.	The characters meet people who have different cultural characteristics.	64, 71
	7.4. Respects different cultures.	Natives with painted bodies	60, 64, 71

3.1.2. Comparison of the Fourth Grade Acquisitions of the Social Studies Curriculum with the Content of the Book

The Social Studies Curriculum for the fourth grade includes seven learning areas, namely 'Individual and Society' (IS), 'Culture and Heritage' (CH), 'People, Places, and Environment' (PPE), 'Science, Technology, and Society (STS), 'Production, Distribution, and Consumption (PDC), 'Active Citizenship' (AC), and 'Global Connections' (GC), as well as 33 acquisitions in total. The cases to use the book content as a context in teaching these acquisitions were examined and presented in Figure 3.

Figure 3 shows that the book can use as a context with all acquisitions in the learning area of PPE, but it cannot use as a context with the acquisitions in the learning areas of CH and AC. Table 2 shows the acquisitions where the book can use as a context concerning the other five learning areas.

According to Table 2, most of the acquisitions listed in the curriculum can associate with multiple subjects/events in the story. Below are examples of the emergence of such associations as presented with the page numbers in the table.

"*SS.4.1.2. Puts the major events of own life in chronological order.*" is described in the curriculum as follows: *"It enables the student to chronologically list the events considers important in own life (birth, first speech, the first date of the school, etc.)"*. Important events in Doctor Fergusson's life are presented in chronological order, such as the death of his parents in an accident and his military service. For example, the following phrases in the story:

"Doctor S. Fergusson was a fearless Englishman in his forties… When he was 22 years old, he lost his parents in a shipwreck... He joined the Bengal Engineers Association to resolve his loneliness... He had served as a volunteer in the Bengal army for about two years... Eventually decided to leave Bengal and settle in England."

"SS.4.3.1. Makes inferences about the location of any place around." is described in the curriculum as follows: "*Location analysis is made regarding directions and distance to natural and human elements. Natural and technological methods and tools to find a direction are discussed.".* For example, a map and a compass are used to determine the location while traveling to Africa with the following phrases in the story:

"…He put on the table the map showing the geographic features of Africa… Look, man. The last travelers reached the place I marked but could not cross south latitude and east longitude... After a comfortable two-hour flight, they reached the African coast. The region below us is Mrima. Look, that high mountain in our northwest is called Nguru in the records... The doctor was looking at the compass and was determining..."

"SS.4.3.4. Observes the weather events occurring around and transfers own findings to pictorial charts." is described in the curriculum as follows: *"Duration of the observation is determined to allow for observation of different weather events. Furthermore, while describing weather events, emphasis is placed on the chart reading and creation skills."* The book treats weather events such as fog, storm, wind, and sunshine as essential factors affecting the journey in a balloon. The book also presents information on these weather events as time-dependent. For example, the following phrases in the story describe the outbreak process of a sandstorm on a time-dependent basis:

"…Before sandstorms, the weather gets warmer like this, and the wind comes to a standstill. Since the current conditions are similar, we can assume that there will be a sandstorm soon… …Next morning... The weather change in the desert was very rapid... Strong windbreaks out... A violent storm replaces the wind."

"SS.4.3.5. Makes inferences about the geographical formations and population characteristics in about the place lives and its surroundings." is described in the curriculum as follows: *"Political and Physical Maps of Turkey are reviewed with the students. While treating this acquisition, literary works such as poems, stories, and epics are used.".* In the book, the story begins with the preparations for a trip to Africa. Then, it continues with the geographical features (geographical formations, population distribution, and cultural structure) encountered during the trip. For example, the following phrases in the story:

"…I thought you liked seeing new places, Joe… I've heard horror stories about Africa, sir. Travelers often faced death… All research trips to Africa. The main reasons are forests, deep valleys, cliffs, harsh climatic conditions, wild places, even cannibals. They were flying over an indigenous village. Probably for the first time seeing a balloon, the locals were shouting in surprise, shooting arrows at Victoria... I have to say that the people of Zanzibar are uncomfortable with this trip, he said... Do they think they will be cursed because of their superstitions?... I studied the beliefs of the local people... He said we are getting closer to civilization with each passing day... To be able to read the daily newspapers, go to the theater, to the concert, to be able to shave in the sink in front of a mirror…."

"SS.4.3.6. Makes necessary preparations for natural disasters." is described in the curriculum as follows: *"Priority is given to natural disasters that are likely to be encountered in the environment where the student lives. Preparation of an earthquake emergency kit is discussed.".* It is seen that the book explains the supply of materials that are likely to be used in case of need during the long journey. For example, the following phrases in the story:

"Maties, the balloon can carry a maximum weight of 1610 kilograms. We will only be able to take 204 kilograms of cargo except for passengers... So, our food, water, and weapons will not exceed 204 kilos in total... I thought of the smallest details for a healthy journey. Compass binoculars, barometer, stopwatch, thermometer, batteries, cables, strings, also light and nutritious as water, tea, sugar, salted meat, rusks, biscuits placed in the basket... A little error, taking too much weight may cause us to drop…."

Related to *"SS.4.4.1. Categorizes the technological products around according to their usage areas."* the book shows that compass, binoculars, barometer, stopwatch, thermometer, batteries, and cables are used from time to time during the Africa trip. For example, the following phrases in the story:

"They spent that night in silence. The eyes of everyone were on the barometer. Even a tiny drop in air pressure makes them hopeful, …and a subsequent rise puts them back in tension... Finally, they entered a suitable air stream after a short while and started to fly towards Lake Chad. The doctor was often looking at the compass, glancing over the map, and making a direction…."

"*SS.4.4.4. Develops ideas for designing typical products based on the needs around."* is described in the curriculum as follows: "*Emphasis is put on exemplary entrepreneurs and their success stories.".* The book mentions the usefulness of the designs of Dr. Fergusson. He designed a balloon for traveling in, which is the book's subject, and a light source to obtain bright light when needed. For example, the following phrases in the story for balloon design:

"… Let me tell you a little bit about the properties of the balloon. The outer part of the balloon consists of a specially woven silk fabric. All threads are custom-made. I don't know if you paid attention to the springs around the basket... Its purpose is clear. Helps to minimize the severity of the blow in the event of a fall or collision…."

For lightening tool design: "*… I'll create a light to dazzle the savages… Doctor Fergusson took action to turn on the bright light that he spoke of. First, he controlled the gas in the compound casing. After removing the wires separating the water and tying two coals to the ends… a very bright light spread and covered the whole forest when*

the two different coals touched each other. Suddenly it brightened like daytime…."

"SS.4.5.2. Recognizes the major economic activities in own family and immediate circle." is described in the curriculum as follows *"Using concepts such as income, expense, budget, production, distribution, consumption, and profession, it enables the student to observe and report on economic activities in their immediate circle".* The book mentions professions such as a doctor, maid, captain, priest, soldier, lieutenant, consul, and scientist, as well as the concept of the employer. For example, the following phrases in the story:

> *"Born to a famous captain and an educated and cultured mother, he grew up in a wealthy community in Bengal... Doctor Fergusson was a true scientist, traveler, and adventurer. On the other hand, he was a reporter for the Daily Telegraph, one of the well-known English newspapers. … However, the opposite was his employer. How could he resist? Moreover, the request was very natural; Because when hired, there was also participation in trips within the conditions alleged. … The British consul and other officials in Zanzibar greeted Doctor Fergusson and his friends with great interest and respect…."*

3.2. Using the Book with Interdisciplinary Approaches in Teaching

It seems that the classifications related to interdisciplinary teaching typically mention multidisciplinary, interdisciplinary, and transdisciplinary approaches. Below are presented the acquisition-book associations that can use in practice for each of these three approaches.

In the multidisciplinary approach, the focus is on the course acquisitions. However, in the context of 'Five Weeks in a Balloon', the acquisitions specific to two courses can be expected to be associated with each other in the student's mind. Particularly in Turkey's elementary school teaching practice, a single teacher can teach science and social studies courses individually in the context of 'Five Weeks in a Balloon'. For an exemplary multidisciplinary practice in the fourth grade, the teacher should independently teach science and social studies courses. However, the teacher can use the book content-acquisition association, which is described in the results section, as a context to bring in acquisitions.

Four different sample applications can be designed using the book 'Five Weeks in a Balloon' for interdisciplinary teaching in the fourth grade. The said applications are explained below:

When examined the book content, a plot about the compass emerges. This plot has three stages. In the first stage, a compass is also included in the material supply list before the journey. In the second stage, the reader encounters the usage of the compass and map for direction finding during the balloon journey. In the third stage, it is seen that the characters suspect that they have difficulties in finding direction because they think they are lost, and then, they discuss whether the compass is broken. The discussion in the last stage of this plot can take to the classroom environment to do interdisciplinary teaching by using the knowledge and methods required by the acquisitions *"SS.4.3.1. Makes inferences about the location of any place around."*, *"SS.4.4.1. Categorizes the technological products around according to their usage areas."* and *"S.4.3.2.1. Recognizes a magnet and discovers its poles."* to find a solution for the discussion.

The book includes a plot about nutrition. Since the subject of the book is a challenging journey, the knowledge and skills required by the acquisitions *"S.4.2.1.1. Explains the relationship between the life and food contents."*, *"S.4.2.1.4. Associates human health with a balanced diet."*, and *"SS.4.3.6. Makes necessary preparations for natural disasters."* can be used by handling events such as a bag preparation for the journey and increased need for food and water due to misfortune during the journey (increased water need due to their staying on the desert longer than they anticipated) as a context. To this end, students may ask to seek an answer to which foods and materials are contained in their bags to survive during a challenging journey.

The book contains many events that explain the necessary conditions for a balloon to hover and move in the air and the preference of a balloon journey. These events start with the balloon design, its loading capacity, and supply of materials. Then, continue with the efforts to carry on the balloon journey when the balloon is damaged due to unexpected situations during the journey. In the context of those events, the knowledge and skills required by the acquisitions *"SS.4.3.5. Makes inferences about the geographical formations and population characteristics in about the place where he/she lives and its surroundings."*, *"SS.4.4.1. Categorizes the technological products around according to their usage areas."* and *"S.4.3.1.1. Performs experiments on the effects of force, which include making objects move and changing their forms."* can be used.

Various design problems encountered by the book's characters and their efforts to cope with these problems are noteworthy. For example, those problems include designing a balloon for the journey and designing a lighting device to emit bright light to rescue the captive from the cannibals they encounter during the journey. Interdisciplinary teaching can perform by asking the students to help the book characters and assign them a challenge to design a balloon or lighting tool concerning the acquisitions *"SS.4.4.4. Develops ideas for designing unique products based on the needs around."*, *"S.4.7.1.1. Recognizes the circuit elements that make up a simple electric circuit as well as their functions."*, and *"S.4.7.1.2. Builds a functioning electric circuit."*.

Transdisciplinary teaching can perform by handling 'Five Weeks in a Balloon' as a context for the fourth grade. Since this requires real-world problems and collaboration with discipline experts, the example of the journey in the book may be treated. For example, touristic hot air balloon rides are organized in Cappadocia, Turkey. Again, similar

to the application in the interdisciplinary approach, a balloon design challenge can be given. But this time, the challenge should be designing balloons for Cappadocia balloon rides as a real-life design. For this, students can take part in the process of finding a solution to a problem by contacting the experts in the balloon repair workshops. Depending on the course of the process, appropriate acquisitions are automatically included in learning studies. Where necessary, teachers may design the learning environments to highlight the relevant acquisitions. Besides, it is possible to select examples that are close to students' living spaces and constitute context. For example, a parachute design challenge may be assigned for paragliding in regions around the Alps. At the same time, students could be allowed to adapt the knowledge and skills they acquire to different situations.

'Journey to the Center of the Earth', another work of Jules Verne, was also examined regarding its relationship with the physics course curriculum. Many relationships were found between the curriculum and the book (Aygün & Şahin, 2020). In an earlier study, 'Around the World in 80 Days', another work of Jules Verne, was matched with some acquisitions in the geography course (Ceylan, 2017). Similar to these studies, one of the study results is that the book 'Five Weeks in a Balloon' can be used separately for both science and social studies courses as a context. On the other hand, it should be noted that these two studies are related to high school curricula. In this study, using a Jules Verne book in teaching by associating it with elementary school curricula is discussed. The book can use as a context for all units in the four learning areas of the fourth-grade Science Curriculum. These are 'Earth and Universe', 'Living Creatures and Life', 'Matter and Its Nature', and 'Physical Events'. In addition, it can be used as a context for five of the seven learning areas in the fourth-grade Social Studies Curriculum. These are 'Individual and Society', 'People, Places and Environment', 'Science, Technology and Society, 'Production, Distribution and Consumption, and 'Global Connections'.

Also, the book 'Five Weeks in a Balloon' will be a context for the fourth-grade science and social studies teaching with a multidisciplinary, interdisciplinary, and transdisciplinary approach. As distinct from its past counterparts, this study reveals the interdisciplinary use of the examined book rather than revealing its use based on discipline. Furthermore, this study revealed sample applications on how it can do. Some of them are design-based, can use for STEM education which is known as a fundamental education approach in recent years (Li, Wang, Xiao & Froyd, 2020), for the interdisciplinary or transdisciplinary approach. It was previously recommended using 'The Purchase of the North Pole, authored by Jules Verne, for STEM education (Yüksel, 2016). Although this suggestion and the result of our study are similar, it should not be forgotten that such an education is related to the competencies of the practitioners. In addition, it should be noted that the expertise of the researchers limits the results of this study. Different researchers may present different application examples and adapt them to different grade levels.

Some literary works can be prepared to teach a specific subject or concept (Maria & Junge, 1993). For example, we can mention The Magic School Bus book series authored by Joanne Cole or NASA's books to teach energy or sound. That is important because it is known that sometimes, concepts in children's books are not compatible with scientific ones (Rice & Rainsford, 1996; Rice, 2002; Sackes, Trundle & Flevares, 2009). It is worth remembering that the book's author under review (Jules Verne) was not a science teacher. Therefore, teachers who will make teaching practices based on our study to be aware that the book's content examined in this study is not analyzed in terms of the correct use of concepts.

CONCLUSION

In conclusion, in fourth-grade science and social studies teaching, the book 'Five Weeks in a Balloon' can use for both multidisciplinary, interdisciplinary, and transdisciplinary education.

Although some of Jules Verne's books might be considered children's books, it is seen that conceptual knowledge is needed in many subjects to understand the content of the examined book. Since the book examined in this study is a translated book, no analysis of concept use was included in the study's scope. Therefore, the teachers who will use this book in their courses by using the associations described in the results recommended being careful about concepts.

In the book, we are faced with sections in individuals who live in different geographical regions, have different cultural characteristics, and have different professions. This situation may eliminate the lack of relationship between courses and daily life. However, this study does not include when, how, and how much to read the course.

Based on this study, many different literary works may examine their potential to use as a context for interdisciplinary teaching at schools. So experimental environments may design using the acquisition-book content associations carried out in this study, or that can be carried out in the future to examine the effects of such teaching on different areas. Besides, the content of this book may be associated with acquisitions at different grade levels.

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