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Unlocking the Science in English Coursebooks: A Critical Exploration of Scientific Literacy[1]

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Abstract

Science is advancing at a rapid pace and the ability to understand it has become a universal necessity. Countries aim to cultivate individuals who comprehend the nature of science, keep up with scientific advancements, and can generate solutions for local and global challenges. Enhancing scientific literacy is generally perceived as one of the primary goals of science education. However, relying solely on science courses to impart this knowledge is not a rational approach. English courses are among the subjects that can contribute to students' scientific literacy enhancement. This is because English lessons require presenting content to students using contemporary language teaching approaches in a meaningful and specific context. One of the most important tools for providing this content is coursebooks. This research investigated the extent to which English coursebooks contribute to scientific literacy through an interdisciplinary perspective. In this study, coursebooks used at fifth, sixth, seventh, and eighth-grade levels at state schools in Turkey were analyzed. The research results revealed that all the examined coursebooks contained activities related to scientific literacy. It was founded that as the learning level increased, components of scientific literacy were more integrated into the coursebooks. In terms of the dimensions of scientific literacy, the scientific process dimension was the most represented in coursebooks with 65 activities. In light of these findings, it was evident that English coursebooks have the potential to contribute to the development of scientific literacy.

Keywords: Scientific literacy, English coursebooks, Interdisciplinary approach

İngilizce Ders Kitaplarında Bilimi Açığa Çıkarmak: Bilimsel Okuryazarlık Üzerine Eleştirel Bir İnceleme

Öz

Bilim hızla ilerlerken, bilimi anlama yeteneği artık evrensel bir gereklilik olarak kabul edilmektedir. Ülkeler, bilimin doğasını kavrayan, bilimsel gelişmeleri takip eden ve hem yerel ve hem küresel sorunlara çözüm üretebilen bireyler yetiştirmeyi hedeflemektedir. Bilimsel okuryazarlığı artırmak, genellikle fen eğitiminin temel hedeflerinden biri olarak kabul edilir. Ancak, bilimsel okuryazarlığı sadece fen derslerine dayandırmak mantıklı bir yaklaşım değildir. İngilizce dersleri, öğrencilerin bilimsel okuryazarlıklarının gelişmesine katkıda bulunabilecek dersler arasındadır. Çünkü, İngilizce dersleri öğrencilere çağdaş dil öğretimi yaklaşımlarını kullanarak belirli bir bağlamda anlamlı içerik sunmayı gerektirmektedir. İçeriği sunmak için kullanılan en önemli araçlardan biri de ders kitaplarıdır. Bu araştırma, İngilizce ders kitaplarının disiplinler arası bir perspektif ile bilimsel okuryazarlığa ne ölçüde katkı sağlayabileceğini incelemiştir. Bu çalışmada, Millî Eğitim Bakanlığına bağlı devlet okullarında beşinci, altıncı, yedinci ve sekizinci sınıf seviyelerinde kullanılan ders kitapları analiz edilmiştir. Araştırmanın sonucunda, incelenen tüm ders kitaplarında bilimsel okuryazarlığı artırmaya yönelik etkinliklerin olduğu görülmüştür. Öğretim seviyesi arttıkça, bilimsel okuryazarlık ile ilişkili aktivitelerin ders kitaplarında daha fazla yer aldığı sonucuna ulaşılmıştır. Bilimsel okuryazarlık boyutları açısından bakıldığında, bilimsel süreç becerileri boyutunun 65 etkinlik ile ders kitaplarında en fazla temsil edilen boyut olduğu görülmüştür. Bu bulgular ışığında, İngilizce ders kitaplarının bilimsel okuryazarlığın geliştirilmesine katkıda bulunma potansiyeline sahip olduğu söylenebilir.

Anahtar kelimeler: Bilimsel okur yazarlık, İngilizce ders kitapları, Disiplinler arası yaklaşım

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INTRODUCTION

Science is advancing quickly in the century we are living in. The ability to understand science is a universal prerequisite for people who don't want to feel isolated from their community or overwhelmed and disheartened by change (United Nations Educational Scientific and Cultural Organisation, 1993). The significance of scientific literacy lies in addressing global predicaments like climate change, energy resources, and public health, which necessitate not only scientific know-how but also effective communication and cooperation across diverse cultural and linguistic backgrounds. Therefore, countries need individuals who understand the nature of science, follow scientific developments, and produce solutions to local and global problems. These individuals are able to create and use scientific knowledge for the growth and prosperity of their society. However, the vast majority of people in a variety of countries are illiterate when it comes to science (BouJaoude, 2002; Özdem et al., 2010). As a result, nations must educate individuals who can understand and use science. In other words, one of the fundamental aims of nations is to improve citizens' scientific literacy. Therefore, scientific literacy has been integrated into educational processes to reach the desired improvements in several educational reforms (Çakici, 2012; Turgut & Fer, 2006).

The significance of scientific literacy has been acknowledged in diverse fields, including education. Initially, scientific literacy can promote interdisciplinary learning and foster a deeper understanding of the world. As noted by Roth and Barton (2004), science is not an isolated subject but a way of understanding the natural and social world. For example, a variety of scientific concepts have connections to language, literature, and culture. In addition, scientific literacy can aid students in fostering the consciousness of worldwide concerns and becoming accountable individuals, as argued by Bybee (1997a).

Considering the essential role of scientific literacy, the aim of science education is to develop individuals who possess a deep understanding of scientific concepts and capabilities (Holbrook & Rannikmae, 2009). Given the numerous difficulties relating to science and technology in today's society, people must be literate in science. However, the idea that scientific literacy is only related to science lessons is not an appropriate inference (Özdem, et al., 2010). Correct comprehension and interpretation of science are intimately tied to the capacity to integrate science with other subjects and apply scientific knowledge and abilities across all disciplines (Özdem et al., 2010). Integrating scientific literacy into lessons across a range of subjects can have two important benefits. First, it can help students develop their scientific decision-making abilities and deepen their understanding of science. Second, as these skills are used in other fields, scientific literacy can become more widespread throughout society.

As stated above, it is necessary to present scientific literacy through other courses. Among these courses, English, as a foreign language, can be an agent for developing scientific literacy. Because, in the course materials used in English language teaching, contents for different fields such as science subjects are presented. In this regard, it is quite probable that scientific literacy can find a place in English coursebooks. Consequently, by integrating scientific topics into English coursebooks, students can broaden their perspectives and make connections between different fields of knowledge.

While English coursebooks have been the subject of various studies such as the views of English language instructors (Akhgar, et al., 2017), the consistency with students' needs (Papajani, 2015), the language skills they focus on (Xiao-jie, 2017), the extension of anthropocentric perspective they include (Yastibas, 2020), it is noteworthy that none have specifically assessed their relationship with scientific literacy. To our best knowledge, there is no study focusing specifically on scientific literacy in English coursebooks. Therefore, this study would contribute to the literature with regards to how English coursebooks relate to science or to what extent their content reflects scientific literacy. This study endeavors to make a valuable and original contribution to the existing body of academic literature by advancing our understanding of the interplay between language education and scientific literacy promotion. In this regard, the current research addressed the following research questions.

1. How comprehensively do English coursebooks address themed topics in scientific literacy?
2. Which scientific literacy sub-dimensions are highlighted in the activities of English coursebooks?

Literature Review

There is no scientific literacy paradigm that all researchers can agree on. The phrase has been used to refer to a wide range of ideas and interpretations since it was first coined in the 1950s (Holbrook & Rannikmae, 2009; Mc Eneaney, 2003). However, to measure scientific literacy, the framework generally includes four themes, that is, science as a body of knowledge, science as a way of investigating, science as a way of thinking, and the interaction among science, technology, and society (Chiappetta, et al., 1991; Chiappetta, et al., 1993). Many

studies followed this framework since it comprises essential elements that are included in practically all definitions of the concept (Bybee & McCrae, 2011; Xuan, et al.,, 2019). The facts, ideas, principles, rules, hypotheses, theories, and models of science required for a person to be scientifically literate are referred to as the knowledge domain (BouJaoude, 2002; Chiappetta et al., 1991). The term science as a way of investigating refers to the methods and abilities used in scientific investigation, such as observing, measuring, classifying, and inferring. The third component, science as a way of thinking corresponds to a focus on how people think, reason, and reflect while creating new scientific knowledge (Chiappetta et al., 1991). The final component of scientific literacy, the interaction among science, technology, and society, refers to the influence of science on society and how society, technology, and science are related (Chiappetta et al., 1991).

This framework was revised by different researchers since the concept of scientific literacy and the traits of scientifically literate people have both been influenced by the world's rapid change. As a result of rapidly changing scientific literacy, some components were inserted such as the use of science in everyday decision-making (BouJaoude, 2002), the effective side of science (Cansiz & Cansiz, 2019; OECD, 2017), and the interrelationship of environment with science, technology, and society (Cansiz & Cansiz, 2019; OECD, 2017; Xuan et al., 2019). Although they include four major scientific literacy dimensions, their sub-dimensions vary in terms of the number of items to measure scientific literacy. In addition, the majority of these frameworks have been designed to evaluate science coursebooks (e.g., biology, physics, chemistry) and science curriculums whose major aim is to improve scientific literacy. In the current study, we utilized the framework of Xuan et al., (2019) because the main aim of English coursebooks is not only to improve scientific literacy but to increase language learners' knowledge and competence in the target language. This framework, therefore, is more suitable for the aim of this research since it is prepared for evaluation of the geography curriculum, that is, a subject different from the science curriculum. The components of the scientific literacy framework are presented in Figure 1.

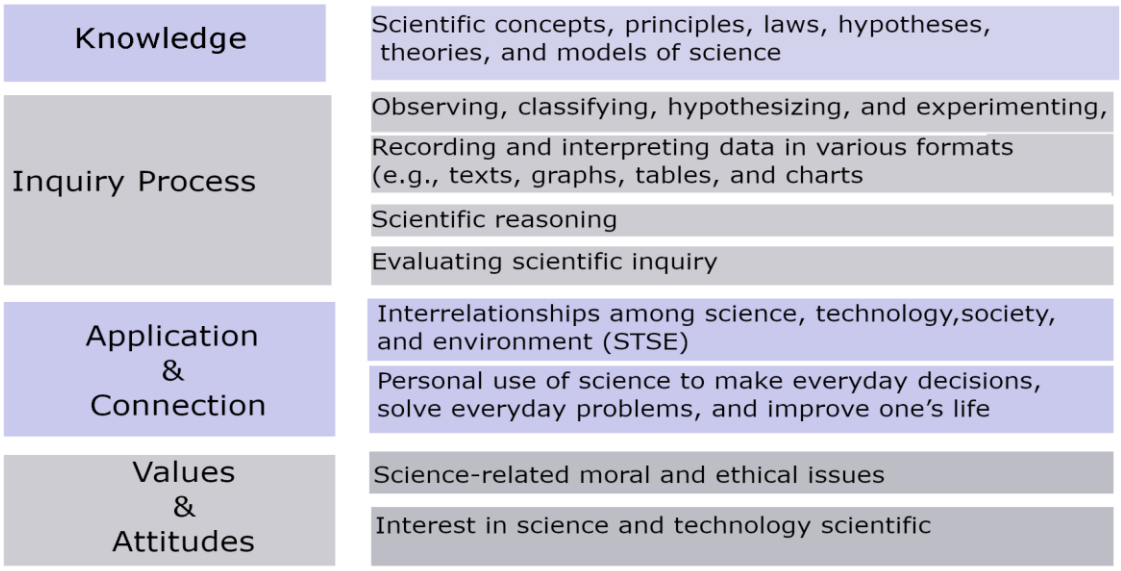

Figure 1. Dimensions of Scientific Literacy

As can be detected from the figure, the inquiry process aspect of scientific literacy was generated by creating "the investigative nature of science" and "science as a way of knowing,". In addition, the affective aspect of scientific literacy was also inserted into the framework with the title of "values and attitıdes".

In light of this framework for scientific literacy, English coursebooks that incorporate scientific topics may provide students an opportunity to develop their scientific literacy and improve their language skills. It is plausible to conclude that science-related topics which are integrated to improve scientific literacy in English coursebooks can also enhance students' language skills. Scientific language is technical and precise, and the use of scientific vocabulary in English coursebooks can help students to expand their English vocabulary and improve their reading and writing skills.

Teaching English as a second language may facilitate scientific literacy as a part of the educational process. Teaching resources, particularly English language coursebooks can be utilized to link English language instruction with scientific literacy. In other words, coursebooks play a crucial role in the learning process in varied learning environments, and having access to high-quality coursebooks can assist students' achievement (Wen-Cheng et al., 2011). Coursebooks significantly influence the progression of learning as they often function as the principal

knowledge source across diverse classroom environments (Chiappetta et al., 1991). Their content and organization directly shape not only what is taught but also how it is delivered, ultimately serving as the primary guide for the curriculum in practice (Chiappetta & Koballa, 2002; Ramnarain & Chanetsa, 2016).

The Ministry of National Education (MoNE, hereafter) is the only responsible institution that regularizes national curricula and coursebooks. Considering the new developments in language teaching methodology, MoNE updated the English language education curriculum and coursebooks prioritizing the communicative aspect of language teaching with a meaningful, contextual, and interdisciplinary perspective. Therefore, the content of the English curriculum holds a significant place in teaching because several contents and skills can easily be transferable to other areas. Integration of content in language education is handled in two ways. One is the integration of language skills such as reading and writing; the other is the integration of different themes of other disciplines into English courses. For instance, the integration of a science theme such as environment can be handled in an English lesson. With an interdisciplinary perspective, students become more motivated towards learning and grasp the value of the things they learn, and become active during the learning process (Aksoy, 2011).

English language teaching was regarded as an academic subject to be learned by concentrating on the acquisition of linguistic structures and vocabulary rather than the interaction of people via the language (Kırkgöz, et al., 2016). Later, the English language teaching curriculum has shifted from the traditional aspect of teaching such as grammar and vocabulary to a more experiential perspective with a focus of communication in English and daily usage. Whatever the methods teachers use, it should be considered that the content of English coursebooks should be presented in a meaningful and contextualized way. Therefore, contents of other disciplines such as science can effectively be used in English coursebooks. In this respect, Aksoy (2011) informs that the integration of interdisciplinary materials into English coursebooks is not a new concept, and it is applied in courses like English for specific purposes. Content-based instruction (CBI) which is a communicative approach in language teaching lets learners focus on learning subjects instead of the language itself. In this respect, CBI is defined as a method that initializes subject matter, benefits from authentic materials, increases the knowledge of learners about the new information, and pays attention to individual needs (Leaver & Stryker, 1989). That is, content-based instruction, which combines the contents of other disciplines with English courses, is the method that helps present the content contextually and may lead to communication practices of learners.

As understood from the explanations above, content integration of different subjects is the main point of interdisciplinary perspectives, which facilitate the interaction of interdisciplinary teaching approaches. Therefore, this study investigates to what extent science topics are integrated into English coursebooks in terms of scientific literacy. It is evident that interdisciplinary teaching is an appropriate approach for foreign language teaching because developing students' communicative skills is highly important with the content integration of other subjects like science (Aksoy, 2011). In other words, the integration of contents with an interdisciplinary perspective helps learners acquire the topics in connected and meaningful ways (Aladağ & Sert, 2020).

METHOD

Research Design

In this study, the document analysis method was employed. Document analysis is a form of qualitative research method, which is performed to review or assess a variety of documents (Bowe, 2009). Therefore, researchers analyze materials that contain information about concepts, events, and situations which are the basic aim of the research. The document analysis approach was purposefully chosen in our research as it perfectly complements our main objective of revealing the scientific aspects of English coursebooks and examining their potential contribution to the development of scientific literacy. The evaluation of textual and audio activities in English textbooks in terms of scientific literacy was clearly revealed through document analysis. In this study, English coursebooks were used as the documents.

Data Selection

5th, 6th, 7th, and 8th grade English coursebooks used in Turkey's secondary state schools in the 2022-2023 academic years were determined as data sources (See appendix). Although there are different books used in each grade, we randomly selected only one coursebook from each grade since the contents of the books in each grade are similar. For instance, the main themes of the 5th grade English coursebooks published by different publishers are the same. That is, the contents of the books include similar topics and activities. In addition, the current research was limited only with the books of English teaching programs of secondary schools. All the coursebooks include

ten units that focus on different themes. By taking into account the scientific literacy framework, activities in the English coursebooks were examined.

Data Analysis

Researchers analyzed English coursebooks via the content analysis technique. Content analysis is defined as the systematic categorization of qualitative or quantitative data according to predetermined themes or groups (Cohen et al.,, 2007; Fraenkel et al., 2012). There were three steps in this research for data analysis. We first searched the literature on scientific literacy to determine the appropriate framework to evaluate English coursebooks. Accordingly, we preferred a revised scientific literacy framework suggested by Xuan et al. (2019) as explained in the literature review. The nature of the study was discussed before coding the data. Agreement was also reached on the meanings of the selected aspects of scientific literacy and the content-relatedness of scientific literacy in the context of English coursebooks. In the second step, evaluation criteria in the context of the determined conceptual framework were defined, taking into account articles (e.g., Chiappetta, et al., 1993; DeBoer, 2000, OECD, 2017) on the topic of scientific literacy. The categories and guidelines for reviewing English coursebooks are outlined below.

- Knowledge: Activities in this category may include the following elements.
    - The scientific knowledge to be learnt should be presented.
    - The knowledge presented to the students can be different types of scientific knowledge such as concepts, principles, laws and theories.
- Inquiry process: The main aim of activities in this category is to have students answer a question or problem through thinking and action.
    - Such activities encourage students to use scientific process skills such as observing, measuring, classifying, drawing conclusions and recording data.
    - Activities suitable for this dimension include answering a question using given information, a graph or table, making a calculation or drawing a conclusion by comparing given values, or drawing a conclusion by reasoning.
- Application and Connection: The activities within this category are designed to illustrate the social impacts and outcomes of science. This facet of scientific literacy focuses on the practical application of science and the role of technology in benefiting or obstructing humanity, often delving into social matters.
    - Common features of activities in this dimension include explaining the benefits of science and technology to society, discussing social issues related to science or technology, and highlighting careers and jobs in science.
    - Applying scientific knowledge and principles in individual's daily lives to help them make informed choices, address common issues, and enhance their overall well-being.
- Values and Attitudes: Students' attitudes, beliefs, motivational orientations, self-efficacy and values are the focus of this type of activity.
    - Activities that focus on an interest in science and technology, environmental awareness and appreciation of scientific approaches to research are common features of the activities.
    - Activities may also focus on being responsible for personal, local, and global issues and respecting ethical standards.

Considering the framework and evaluation criterias, researchers independently examined each activity in the coursebooks including listening audios, and coded them into one of the components of scientific literacy by using MAXQDA 20 qualitative data analysis software. In the final step, they compared their analyses and found that there was an 87.2% consistency between the researchers based on the formula of total number of agreement between the raters divided by total number of agreement and disagreement (Miles & Huberman, 1994). The interrater reliability was calculated and found to be statistically significant (Cohen's Kappa = .743, $p < .000$), which indicates excellent agreement among the researchers, based on Landis and Koch, (1977) criteria.

Research Ethics

In our research, we have employed document analysis as the primary method of investigation. Therefore, it is not required to get any ethical permission concerning this research.

FINDINGS

Coverage and Depth of Science Process Skills in English Coursebooks

The science content in the English coursebook covers a range of topics, from health and nutrition to technology and natural forces. While there are similarities across the grade levels, such as a focus on health and the environment, each grade level introduces new and different topics, allowing students to develop a diverse and well-rounded understanding of science.

Table 1. Distribution of Units On Scientific Literacy

Grade 5	Grade 6	Grade 7	Grade 8
Health (Unit 5)	Yummy Breakfast (Unit 2)	Biographies (Unit 3)	On the Phone (Unit 4)
Animal Shelter (Unit 9)	Whether and Emotion (Unit 3)	Wild Animals (Unit 4)	The internet (Unit 5)
	Saving the Planet (Unit 9)	Dreams (Unit 7)	Adventure (Unit 6)
		Environment (Unit 9)	Chores (Unit 8)
		Planets (Unit 10)	Science (Unit 9)
			Natural Forces (Unit 10)

Table 1 shows that English coursebooks span various science topics across grade levels. In the 5th grade, they focus on health and animal welfare. In the 6th grade, topics include food choices, weather, and environmental conservation. The 7th-grade book covers scientists, wild animals, dreams, and the universe, while the 8th grade delves into technology, time management, physics, chemistry, and natural forces. These diverse topics engage students across different grades.

The science content covered in the English coursebooks varies significantly across the different grade levels, but some similarities can be drawn. For instance, there is a consistent focus on health and the environment throughout the four grades. In the 5th grade book, students learn about healthy eating and exercise, while in the 6th grade one, they continue to explore the science behind nutrition and also delve into environmental issues such as climate change. Similarly, the 7th-grade book includes a unit on the environment, and in the 8th-grade book, students learn about natural forces that shape the planet.

The coursebooks include sixteen units across four grade levels, with some of them containing a substantial amount of scientific content. In the 5th grade coursebook, only one out of the two units, "health", falls under the scientific domain. In the 6th grade coursebook, two out of three units are directly related to science content, "Yummy Breakfast" and "Saving the Planet", while "Whether and Emotion" cover limited activities related to scientific literacy. The 7th-grade coursebook has a total of three units, which are strongly related to science content out of five units, namely, "Environment", "Wild Animals", and "Planets". Lastly, in the 8th-grade coursebook, two out of six units, "Science" and "Natural Forces", are directly related to scientific literacy, while the other four units do not. Overall, eight units out of fifteen are totally dedicated to scientific literacy across all four grade levels. In conclusion, English coursebooks serve as valuable tools for imparting scientific literacy to learners.

In the present study, a comprehensive analysis of all activities within the units of English coursebooks for grades 5, 6, 7, and 8 was carried out. Furthermore, the number of activities specifically related to scientific literacy was determined as shown in Table 2.

Table 2. Number of the Activities inside the English Coursebooks

	Grade 5	Grade 6	Grade 7	Grade 8
Scientific Literacy related activities	11	24	73	52
Percentage of Scientific Literacy related activities	4.7%	9.4%	33.7%	20.39%
Total number of activities	234	253	216	255

As shown in Table 2, a total of 234 activities were identified in the 5th-grade book, 253 in the 6th-grade book, 216 in the 7th-grade book, and 255 in the 8th-grade book. Upon closer examination, it was observed that the proportion of activities related to scientific literacy varied across grade levels. In the 5th-grade book, 11 out of 234 activities (4.7%) were found to be associated with scientific literacy. This proportion increased to 9.4% (24 out of 253 activities) for the 6th-grade book. A more substantial rise was observed in the 7th-grade book, with 73

out of 216 activities (33.7%) being related to scientific literacy. However, the 8th-grade book showed a decrease in this proportion, with 52 out of 255 activities (20.39%) being linked to scientific literacy.

Dimensions of Scientific Literacy Across Grade Levels

The results of this study reveal the distribution of activities related to the dimensions of scientific literacy in English coursebooks across grade levels. The dimensions of scientific literacy include Knowledge, Inquiry Process, Application & Connection, and Values and Attitudes. The analysis of the activities also reveals a distinctive distribution pattern, which is presented in Table 3.

Table 3. Distribution of Scientific Literacy Dimensions Across Different Grade Levels

	Grade 5	Grade 6	Grade 7	Grade 8	Total
	f	f	f	f	f
Knowledge	1	3	25	9	38
Inquiry process	7	9	26	23	65
Application & Connection	2	12	11	15	40
Values and Attitudes	3	10	21	11	45
Total	13	34	83	58	188

Among the four dimensions, the Inquiry Process dimension had the highest number, with a total of 65, indicating a strong emphasis on fostering students' skills to investigate scientific concepts and develop problem-solving abilities. The Values and Attitudes dimension comprised 45 activities highlighting the importance of nurturing students' understanding of the ethical, social, and cultural implications of science. The Knowledge dimension encompassed a total of 38 activities, which reflect the focus on building a solid foundation of scientific concepts and principles. Lastly, the Application and Connection dimension included 40 activities, emphasizing the relevance of applying scientific knowledge to real-world situations and promoting interdisciplinary connections. Overall, the distribution of activities across the dimensions of scientific literacy underscores the diverse aspects of science education and the need for a balanced approach to nurturing well-rounded scientific literacy skills in students. Table 4 shows the sample activities included in various dimensions of scientific literacy.

The knowledge dimension is exemplified by many activities, for example, an activity in the nineth unit of the sixth grade book focusing on the 3R rules of reuse, reduce, and recycle. This activity serves to inform students about environmentally friendly practices and their importance in daily life. The inquiry process dimension is represented by some activities as in the example of students classifying planets based on their certain characteristics, such as distance from the sun and size in tenth unit of the seventh grade book. With respect to the application and connection dimension, an example can be given through an activity located in the fourth unit of the seventh grade book. In this activity students discuss ways to protect endangered animals, engaging students in real-world problem-solving. Lastly, the values and attitudes dimension is examplified in a passage of the eighth unit of eighth grade book describing Japanese students' environmental cleaning practices, highlighting their moral responsibilities and prompting learners to reflect on their values and attitudes.

The analysis of the activities in the English coursebooks revealed that some activities encompassed multiple dimensions of scientific literacy, further illustrating the complexity of the subject matter. For example, in the 7th-grade coursebook, five activities were found to address two distinct scientific literacy dimensions, while three activities simultaneously covered three different dimensions. The incorporation of various dimensions of scientific literacy within activities in English coursebooks can provide students with a comprehensive understanding of scientific concepts and their real-life applications. One such activity, featuring a dialogue between Aslı and Betty in the tenth unit of the eight grade book, effectively demonstrates the integration of multiple dimensions of scientific literacy, specifically “knowledge” as well as the sub-dimensions of “interrelationships among science, technology, society, and environment”, and “personal use of science to make everyday decisions and solve everyday problems”.

In the dialogue mentioned above, Aslı raises concerns about the Amazon Forests' destruction and the effects of climate change, stating that "Nearly 60% of them will disappear by 2030 because people cause an enormous destruction in this area" and "climate change because of global warming has negative effects on these forests." This part of the conversation showcases a sample for the knowledge dimension of scientific literacy. The dimension of Application & Connection becomes apparent when Betty asks, "You're right but what shall we do about this? We can't cope with this.", which demonstrates the need for personal involvement in addressing environmental challenges. Aslı highlights the importance of individual action in addressing environmental challenges, explaining, "I'm sure if we take precautions individually, it will be significant as a whole. This world is our home. So, I think we should shoulder responsibilities to save it.". This part of the conversation illustrates

the sub-dimensions "interrelationships among science, technology, society, and environment," and “the personal use of science in everyday contexts”.

The comparison of activities across the grade levels indicates that the Inquiry Process dimension has the highest number of activities overall, followed by Values and Attitudes, Knowledge, and finally, Application & Connection. When comparing the distribution of activities within each dimension, it becomes evident that the Knowledge dimension experiences a significant increase in activities from grade 6 to grade 7, while the other grades exhibit relatively fewer activities. In contrast, the Inquiry Process dimension displays a more balanced distribution across the grade levels, with a slight increase in activities from the 6th-grade to the 7th-grade book and a more substantial increase from the 7th-grade to the 8th-grade book. For the Application & Connection dimension, there is an observable growth in activities from the 5th grade to the 6th grade, followed by a relatively stable number of activities in the 7th-grade and 8th-grade books. The Values and Attitudes dimension exhibits an increase in activities from the 5th grade to the 6th grade and a further increase from the 6th grade to the 7th grade, followed by a slight decrease in activities in the 8th-grade book.

In summary, the distribution of activities related to the dimensions of scientific literacy varies across grade levels, with a general trend of increasing numbers of activities as the grade levels progress. The Inquiry Process and Knowledge dimensions receive particular emphasis in the English coursebooks, suggesting that these aspects of scientific literacy are prioritized as students advance through their education.

DISCUSSION & CONCLUSION

To answer the first research question regarding to what extent English coursebooks cover scientific literacy, the findings indicate that a variety of topics like health, planet, technology, etc. are connected with scientific literacy. Students are exposed to elements of scientific literacy in their English language courses, even if the specific term "scientific literacy" is not explicitly mentioned in the curriculum. When the coursebooks are analyzed based on their grade level, we can say that when the grade levels of the students increase, it is more probable for students to encounter scientific topics in English coursebooks. The current study indicates that the seventh and eighth-grade English coursebooks include more themed units related to scientific literacy than the fifth and sixth-grade coursebooks do. In a similar vein, the number and percentage of activities related to scientific literacy out of all the activities dramatically increase in the seventh and eighth-grade English coursebooks. For instance, the percentage of activities related to scientific literacy is around five percent in the fifth-grade book; however, this number increases by nearly 34 percent in the seventh-grade English coursebook. Therefore, it can be maintained that scientific literacy becomes more visible in the seventh and eighth-grade English coursebooks than in the fifth and sixth-grade ones. People’s need for science increases more as individuals begin to integrate into society because global problems that can be solved through science become the problems of individuals. For example, climate changes and genetically modified organisms can be the problems of every individual as well as the problems of societies. Therefore, increasing students’ scientific literacy may enable individuals to find reasonable solutions to these problems. At this point, the increase in the number of activities related to scientific literacy in English coursebooks as the grade level increases can be considered as a strategy to address the social problems that students may encounter. Because scientific literacy not only meets the needs of people who deal with science but also responds to the needs of all people to adapt themselves to the challenges of a rapidly changing world (Holbrook & Rannikmae, 2009). Similarly, it was stressed that scientific literacy development of students is an ongoing process starting from the early years of education (Krontiris-Litowitz, 2003; Shaffer et al., 2019). Thus, an increase in the scientific activities in the coursebooks based on the grade levels may contribute to the ongoing development of scientific literacy.

Scientific literacy is not only limited to the knowledge level of people but related to the changes in the natural world that are shaped by people’s scientific decision-making and acting processes. In this regard, maturation can play a significant role in students’ understanding of scientific knowledge since some scientific literacy attributes can be gained at later times. For instance, the nature of science education includes several attributes such as the nature of science, personal development, and social development attributes (Holbrook & Rannikmae, 2009). In other words, students need to have some intellectual capacity such as understanding the basic concepts of science as well as other higher-order thinking skills and attributes such as interdisciplinary perspective. That is, through maturation, students get the ability to connect science and other human endeavors such as learning a foreign language and relating some aspects of science with their personal lives and societal issues. ıt can be concluded that when the ages of students increase as in the example of this study, students’ understanding of scientific literacy may advance depending on their ages. On the other hand, cognitive

development of learners may facilitate the acquisition of scientific concepts as well as a second language learning. For instance, Barac, et al., (2014), in their review study on the cognitive development of bilingual learners, revealed that bilingual children have more advanced capacity than the monolingual children. It can be said that learning a language other than mother tongue may increase the students' cognitive capacities and hence they can be more successful in other topics as a result of their cognitive development. Similarly, Jia et al., (2006) acknowledged in their study on the verb processing in different age groups of bilingual learners that those who are older age groups significantly outperformed in the correct usage of English. Therefore, it can be said that maturation is an indispensable aspect of learning in that students who are in older ages may have more cognitive capacity and development and their cognitive development may facilitate the acquisition of scientific literacy as well as English. Henceforth, adding more themed units and more scientific literacy-related activities in the seventh and eighth grades English coursebooks seems meaningful as the density of scientific literacy-related activities increases depending on the maturation of learners.

Another considerable point is related to how relevant the science concepts are to the personal lives of students. Holbrook and Rannikmae (2009) emphasize that the relevance of school science is vital for the advancement of scientific literacy. In other words, when the students' perception toward the content of scientific literacy is satisfied by considering their personal and career goals, such relevance may trigger the students' motivation toward learning scientific concepts as well as English learning as they are handled together. From the teaching perspective, relevance can be connected with the initial effect of learning. With relevance, students can get answers to the question of why we study this. In other words, it may create a perception that being scientifically literate may be useful, meaningful, helpful for their understanding of the world, and effective for the regulation of their personal lives.

Considering the second research question, the English coursebooks analyzed in this study encompass a diverse range of activities related to scientific literacy, including all sub-dimensions of scientific literacy. As scientific literacy encompasses multiple dimensions, overlooking certain aspects or disproportionately emphasizing one aspect will inevitably impact educational results. As future members of society, students should possess at least a basic understanding of different aspects of scientific literacy since they will encounter science-related issues in their lives even if they do not pursue careers in scientific fields (Krajcik & Sutherland, 2010). Consequently, previous studies have primarily focused on determining the extent to which curricula and coursebooks incorporate scientific literacy. Accordingly, science curricula exhibit a disproportionate emphasis on a single dimension of scientific literacy, such as the knowledge aspect, while neglecting the consideration of the other aspects (Cansiz & Cansiz, 2019; Erdogan & Koseoglu, 2012). Contrary to the research on the evaluation of science coursebooks and curricula in the literature (e.g., Cansiz & Cansiz, 2019; Chiappetta et al., 1993) our investigation revealed that the components of scientific process skills were represented more evenly across a range of activities in English coursebooks. This balance might be due to the fact that the primary objective of English coursebooks is not to teach science concepts, but rather to develop language skills. The unique characteristic of English coursebooks, in which scientific process skills are more equitably represented, could potentially offer a solution to the imbalance found in science coursebooks concerning various dimensions of scientific literacy. By incorporating a more balanced approach to scientific literacy, English coursebooks may inadvertently provide students with a more comprehensive understanding of scientific concepts and skills. This, in turn, could contribute to a more well-rounded education, fostering scientific literacy development in conjunction with language acquisition.

English coursebooks have the potential to help students become more literate in science, which is important in today's increasingly complex world. By utilizing English coursebooks, learners can acquire an understanding of intricate scientific subjects and develop the necessary skills for effective communication within scientific contexts. On the other hand, it should be considered that the language of science significantly differentiates from the everyday language (Parkinson, 2000) regarding grammatical features, genre, etc.; therefore, more radical embedding is required than simply using the content of science for grammar and skill based exercises. However, it is important to acknowledge that students' scientific literacy enhancement does not solely rely on coursebooks. Factors such as teaching methodologies, learning environments (Üstün et al., 2020), and the quality of educators (Ding, 2022) also play a vital role in shaping students' scientific literacy development. Given the integral role English coursebooks play in providing content-rich scientific topics, one could reasonably argue that English teachers hold a pivotal position in the teaching and development of scientific literacy among students. Yet, the key role that English teachers could play in enhancing scientific literacy, considering the scientific content in English coursebooks, has been seemingly overlooked. Given these considerations, further research is imperative to gain a holistic understanding of the impact of English coursebooks on students' scientific literacy. Future studies should

specifically explore classroom teaching practices and English teachers' beliefs about scientific literacy, as these elements are critical in determining the overall learning experience and fostering the growth of students' scientific literacy skills. A comprehensive approach to examining these factors will enable the development of more effective strategies to improve students' scientific literacy through English education.

Integrating science topics into English coursebooks can be an effective way to improve students' achievement in science and language education. In other words, goals in science and language can mutually support each other. Research showed that the tools and skills developed through language education, such as reading comprehension and communication skills, can be effectively used to facilitate scientific inquiry, or the process of asking questions and seeking answers in a scientific context (Akerson,2001; Dickinson &Young, 1998). By including science topics such as space exploration, climate change, genetics, medical science, robotics and artificial intelligence, and energy, teachers can help students see the relevance and importance of science in their lives. By showing students how science is integrated into our daily lives and how it can provide solutions to complex problems, language teachers can inspire students to pursue science-related careers and become engaged citizens who understand and appreciate the role of science in society.

Subjects like Astronomy and Paleontology, particularly involving dinosaurs, are known to stir a deep sense of intrigue and curiosity among learners (Lelliott & Rollnick 2010; Salmi et al., 2017). The fascinating mysteries of outer space, or the ancient, titanic creatures that once roamed our earth, are topics that can effectively kindle the inherent desire of learners to explore and understand. In our coursebook analysis, we encountered topics on Astronomy, providing a window into the vast cosmos for students. However, it was notable that there were no subjects involving dinosaurs, a topic that is frequently a favorite among young learners. This presents a missed opportunity to harness the appeal of such engaging topics. Considering this, integrating scientific topics into English lessons could be a powerful strategy to enhance students' motivation and success in the subject. By bringing such captivating topics into the English language classroom, we can channel the students' interest in science toward improving their language skills. For instance, the 8th-grade coursebook and unit one friendship includes offering and accepting or refusing to offer with role play dialogues for different contexts. An offer for visiting science museums and science centers would contribute to students’ curiosity. As part of future coursebook revisions, we strongly recommend the inclusion of high-interest, curiosity-stimulating subjects such as dinosaurs. By doing so, we can harness the power of intrinsic motivation, catalyzing learning through the compelling vehicle of students' curiosity and interest.

It is crucial to note that the effectiveness of integrating science topics into English coursebooks relies heavily on the extent of implementation. In the study of Waldrip (2001), primary school teachers believe employing a science-based theme without solid ties to language is less productive. Conversely, creating robust links among the disciplines facilitate a more profound comprehension for students. Therefore, it can be concluded that for the desired success of students in their lessons, English teachers need to effectively utilize the science topics presented in the language coursebooks. Overall, integrating science topics into English coursebooks not only improves students’ language skills but also helps create a more scientifically literate and engaged student.

Statements of Publication Ethics

We declare that the study has no unethical problems, and there is no need for ethics committee approval since the research is based on document analysis.

Researchers’ Contribution Rate

The researchers equally contributed to the study.

Conflict of Interest

There is no conflict of interest between the authors.

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APPENDIX

The name and publisher of the books analyzed in the context of the current research.

Ceylan, C., Gümüş, G., & Kabukçu, G. (2022). Ortaokul ve İmam Hatip Ortaokulu.Happy English 5. Başak Matbaacılık ve Tanıtım, Ankara.

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