



Pre-service Science Teachers' Views on Reading Comprehension and Texts with Scientific Content

Kübra YILDIZ¹, Sibel UYANIK², Elif BENZER³

¹ Marmara University, Institute of Educational Sciences, Türkiye, kyildiz21@marun.edu.tr, <https://orcid.org/0000-0002-3480-4555>

² Marmara University, Institute of Educational Sciences, Türkiye, sibel.uyanik@marmara.edu.tr, <https://orcid.org/0000-0001-9490-2272>

³ Marmara University, Institute of Educational Sciences, Türkiye, epehlivanlar@gmail.com, <http://orcid.org/0000-0002-2518-768X>

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Abstract – Today, reading comprehension in science education is seen as an important skill for achieving international science education goals. In this context, it becomes more important to examine pre-service science teachers' competencies and views on this issue. This study aims to examine pre-service science teachers' views on the importance of scientific texts and reading comprehension in science education. Case study, one of the qualitative research method designs, was used in the study. The opinions of pre-service science teachers about scientific texts and reading comprehension were obtained through an opinion form consisting of open-ended questions. After the opinions were collected, a seminar was given to the pre-service teachers about the strategies used in the evaluation of scientific texts and reading comprehension. At the end of this seminar, the pre-service teachers were asked to design an activity for middle school students that included a scientific text and reading comprehension questions based on the text. After the activity design, the opinions of 9 pre-service teachers who volunteered and represented a range of achievement levels in activity design were collected again using a detailed opinion form. According to the results of the study, pre-service science teachers hold the view that reading comprehension in science education provides cognitive development, improves conceptual understanding and increases the retention of knowledge. Pre-service science teachers have positive attitudes toward the importance of reading comprehension in science education; they believe that scientific texts used for this purpose should be simple, understandable, supported by visuals, and designed to include assessment activities.

Keywords: Reading comprehension, science education, scientific texts, pre-service science teachers.

Introduction

When the international PISA, TIMSS and national central exams conducted to determine the level of achievement of the goals of science education are examined, it is revealed that science scores and reading scores are strongly related (Bayat et al., 2014; Martin & Mullis, 2013). In order to achieve the targeted science achievement in these exams, students' reading skills need to be improved (Cromley, 2009; Durgun & Önder, 2019). Students need to be introduced to texts with scientific content in order to acquire skills such as self-control, critical and reflective reading, including reading comprehension (Yore et al., 2003). In this context, pre-service science teachers, who are expected to use scientific texts in their lessons in their future teaching practice, should be prepared to enrich science learning with scientific texts that they will create with the integration of different types of resources (Binns et al., 2020). Previous studies have explored various aspects of pre-service science teachers' engagement with scientific texts, such as their attitudes towards reading them (Can & Öztürk, 2019), general opinions on science-related reading (Yore, 1991), and their practices in developing instructional materials involving scientific texts (Macceca, 2013). However, their specific views on reading comprehension within science education, particularly regarding the strategies they employ while preparing or working with scientific texts, remain underexplored. Therefore, the present study aims to examine pre-service science teachers' views on reading comprehension and scientific texts in science education.

Theoretical Framework

Reading is one of the most important tools used in the acquisition of knowledge (Benzer, 2016) and is seen as an aspect of the act of knowing and also as a creative act (Freire, 1983). Reading comprehension is not only a result of reading but also a meaning-making process that covers the whole reading process. It is also an important indicator of academic and psychosocial outcomes (Gough et al., 2018). Considering the role it plays in the processes of acquiring, sharing and structuring knowledge, it can be said that reading comprehension is an important part of learning (Tarchi, 2010). In this context, reading activities in lessons can be used to activate prior knowledge, arouse interest in new information, consolidate, explain or elaborate the information learned (Broncano et al., 2011).

In order for students to develop into self-directed, critical and reflective readers in reading comprehension and thus readers of the information age, it is necessary to introduce them to a variety of scientific texts beyond textbooks (Yore et al., 2003). Text types are analyzed under two headings: informational and literary text types. Informative text types

include scientific writings, articles, historical writings, essays, criticisms and news texts (Tavşanlı & Kaldırım, 2018). In this study, the types of informative texts prepared by pre-service teachers were described as texts with scientific content, as they include scientific writing. Scientific texts are commonly found in children's books, magazines, newspapers, and on the internet. Although science teachers have generally paid little attention to the use of scientific texts, reading is often considered a more effective way to understand complex concepts in science education than merely observing experiments or listening to explanations (Wellington & Osborne, 2001).

Reading Comprehension in Science Education

Reading comprehension plays a crucial role in science education, a fact supported by both national and international assessments. For example, Cromley (2009) analyzed PISA results from 2000, 2003, and 2006 and found that countries with stronger reading comprehension skills tend to perform better in science. Accordingly, the necessity of science texts to increase success in science courses was emphasized. In addition, when the science and reading scores of 34 countries with low and high achievement participating in the TIMSS exam were analyzed, it was found that science and reading scores had a high correlation and the importance of reading skills for success in science was revealed (Martin & Mullis, 2013). In addition to the aforementioned international exams, it has been stated that reading comprehension and science achievement are strongly related in the central high school transition exam applied in Türkiye (Bayat et al., 2014) and in general academic achievement (Cromley et al., 2010; Durgun & Önder, 2019). This strong relationship between reading and science learning is complicated when it comes to reading with scientific content. This is because, for students who learn through reading, the biggest challenge is the academic written language in which science is taught. Academic language should be short, concise and reliable. However, to achieve all these characteristics, unfamiliar vocabulary and complex grammatical structures are used, which impair reading comprehension and hinder learning. Reading scientific content is not interesting for many students and requires the reader to be active and reflective. At this point, while overcoming the difficulties encountered during reading which is a mental activity, students can use reading strategies that are handled in three parts: pre-reading, during-reading and post-reading (Tuna, 2016). These steps are outlined by the Common Core State Standard [CCSS] (2010); 1) Provide a full description of the strategy, explain when and how it should be used. 2) Design how the strategy will be implemented. 3) Create opportunities for collaborative realization of the strategy. 4) Guide your students in

using the strategy. 5) Encourage the student to use the strategy independently. These steps can be adapted to support students in reading and understanding scientific texts. For instance, explaining how to identify key concepts, guiding students in analyzing data-heavy paragraphs, and encouraging peer discussion can enhance science text comprehension. These practices are also supported by empirical research on reading in science contexts (Fang & Wei, 2010; Johnson & Zabrucky, 2017). The teacher, then, plays a key role in students' use of reading strategies. The teacher should provide the environment, plan, and guide students' reading comprehension (CCSS, 2010). It has been observed that there are studies on reading comprehension conducted with teachers or pre-service teachers in different fields, most of these studies are in the field of language education, and very few of them are in science education. In these studies, teachers' reading comprehension levels in terms of different variables (Agrusti & Damiani, 2014; Baltacı, 2021; Benzer, 2016; Tarchi, 2010), attitudes and beliefs towards reading comprehension (Can & Öztürk, 2019; Yore, 1991) were investigated. In the literature, there are various studies focusing on pre-service science teachers' interactions with scientific texts. For instance, Can and Öztürk (2019) examined pre-service teachers' attitudes toward reading scientific texts and emphasized the need to design activities that would encourage their engagement with such materials. However, pre-service teachers' specific views on the process of reading comprehension in science education particularly their perceptions following the experience of preparing scientific texts have received limited attention.

Revealing pre-service teachers' views on these processes not only contributes to their self-awareness but also provides valuable data for restructuring instructional environments in alignment with these competencies (Caprara et al., 2011; Khanshan & Yousefi, 2020). Especially after engaging in authentic tasks such as preparing scientific texts, pre-service teachers are better able to articulate their perceived competencies, needs, and challenges related to reading comprehension (Ambusaidi, 2014; Bati, 2022). These practical experiences help them not only assess their existing skills but also develop strategies to meaningfully integrate reading comprehension into science instruction (Gao et al., 2022; Ryan & Hendry, 2023).

In this regard, identifying pre-service teachers' awareness of the importance of reading comprehension in science education, evaluating their competencies in preparing and using scientific texts, and systematically analyzing their perspectives on these processes has the potential to fill an important gap in the literature. Notably, comprehensive studies that address

the components of reading comprehension such as importance (Martin & Mullis, 2013), planning (Sayın & Takıl, 2023), evaluation (Coşkun, 2011; Karabay 2013), implementation (Ambusaidi, 2014; Mawyer & Johnson, 2017), and self-efficacy (Göktentürk et al., 2025; Khanshan & Yousefi, 2020) within the context of pre-service science teacher education are scarce.

Accordingly, this study aims to explore pre-service science teachers' views on reading comprehension and scientific texts in science education, based on their experiences in preparing text-based activities. It seeks to contribute to the science education literature at both theoretical and practical levels. Recent studies in the Turkish context have also drawn attention to the relationship between reading-related competencies and science learning, particularly among students. For example, Akyol and Çoban Sural (2020) demonstrated that enhancing reading motivation led to measurable improvements in reading comprehension among elementary students with learning difficulties. Similarly, Özer (2024) found that concept-focused reading instruction in science education positively influenced middle school students' conceptual understanding, inquiry skills, and reading comprehension. While these studies offer valuable insights into how reading practices support science learning, they primarily focus on students. However, research addressing pre-service science teachers' perceptions (Smith et al., 2025), self-efficacy (Göktentürk et al., 2025; Khanshan & Yousefi, 2020) and instructional experiences (Ambusaidi, 2014; Mawyer & Johnson, 2017) related to reading comprehension and scientific texts remains limited. This gap underscores the importance of the present study, which aims to fill this void by investigating these processes from the teacher candidate perspective. Furthermore, the study is significant in that it reveals the usability of scientific texts for improving reading comprehension from the perspective of pre-service science teachers. In this direction, the problems of the research are as follows:

1. What are the views of pre-service science teachers about reading comprehension and scientific texts in science education?
2. What are the opinions of pre-service science teachers about reading comprehension in science education, scientific texts and their professional competencies in this subject after the activity designs?

Method

Research Design

Teachers' competencies in reading comprehension and gaining these skills are very important for the quality of the education system (Baltacı, 2021). In this regard, teachers' awareness of the importance of reading comprehension in science education as well as their competence in integrating reading comprehension activities in science education will allow them to bring many benefits into the classroom environment. In this study, a case study design, one of the qualitative research method designs, was used. In a case study, the factors related to one or more situations are investigated with a holistic approach and in-depth research is conducted on how they affect the relevant situation and how they are affected (Yıldırım & Şimşek, 2021). In this context, we focused on determining the awareness, needs and general situation of pre-service teachers by getting their opinions about the importance of reading comprehension in science education. For this purpose, pre-service teachers were asked to express their opinions on the questions related to the subject through online forms. The pre-service teachers first expressed their opinions without any training on the subject. Then, they were given a seminar and asked to create a scientific text and reading comprehension questions similar to the example presented to them. After the seminar, a detailed interview form was applied. In this context, the pre-service teachers' circumstances regarding reading comprehension and use of scientific text in science education were analyzed before and after the activity they prepared with specified procedure.

Participants

The study group was divided into two groups according to the pre-service teachers' participation in the data collection tools. There are 24 pre-service teachers (21 females and 3 males) who volunteered to participate in the preliminary opinion form that reveals the initial situation in reading comprehension. In the detailed opinion form, there were 9 volunteers (8 females and 1 males) selected by maximum diversity sampling method. Based on the maximum variation sampling method determined in the study, three pre-service teachers from each group (low, medium, and high scores) were selected according to the scores they received from the informative texts they were expected to prepare. All of the pre-service teachers in the study group participated voluntarily at each stage.

Data collection

The process of data collection through training seminars, preparation of activities and implementation of opinion forms are shown in Figure 1.

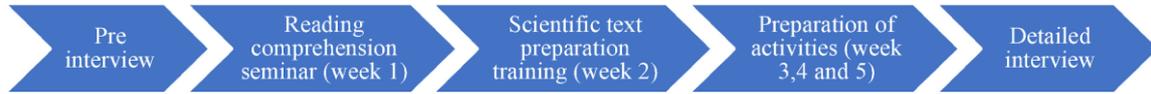


Figure 1 Data Collection Process

The pre-interview form was administered in class by sharing the online link with the pre-service teachers and asking them to fill out the form. Although most of the pre-service teachers filled out the form at this stage, they were given time to fill out the form within a five-day period.

The reading comprehension seminar was given to the pre-service teachers as a two-hour seminar by a faculty member who has been teaching the “Critical and Analytical Thinking” course for several years and also by one of the researchers. The seminar course included definitions about reading, reading comprehension, critical reading, making inferences based on what they read and what scientific texts are. At this stage, the role of the definitions and concepts in science education was not specified in a way might influence the pre-service teachers' opinions during the week of preparing scientific texts, the researcher, who is a faculty member, defined scientific texts containing science concepts and relationships between concepts and field-specific skills in a two-hour lesson. In this process, pre-service teachers were shown examples and their questions were answered. After the lesson, the pre-service teachers were asked to create a text with scientific content and reading comprehension questions about this text in groups of three or four with their groupmates of their choice. In the study, over a three-week period, nine pairs of concepts selected from the field of science were distributed to the groups formed. Each group prepared a scientific text that included the concept pairs assigned to them. In addition, they developed text-based (reading comprehension) questions related to these texts. Throughout the process, pre-service teachers were expected to conduct a literature review for the informative texts they were preparing, include reading elements that foster higher-order thinking skills, and construct scientific texts integrating their own ideas with scientific sources. After all of the pre-service teachers completed and submitted their activity designs, the detailed opinion form was applied online. In this process, in line with the approval of the ethics committee, the personal information of

the pre-service teachers participating in the study was not written in the study, and the pre-service teachers were assigned codes such as TC1, TC2... etc. for the interviews.

Preliminary Opinion Form

The opinions of pre-service teachers about reading comprehension in science education are important to determine their current situation before starting the activities. At this point, a pre-interview form was used to obtain pre-service teachers' views on reading comprehension and the application of science texts as a way of using reading comprehension in science education. The scope of the form was determined in four categories in order to reveal the pre-service teachers' views on the importance of reading comprehension in science education, how to improve reading comprehension in science education and how to prepare scientific texts in accordance with the content of science education as a way to do this, and in which ways and how reading comprehension can be evaluated in science education. In the preliminary opinion form prepared by the researchers based on the literature review (Coşkun, 2011; Karabay, 2013), there are six questions in total to cover the aforementioned categories. The validity of the questions was evaluated by a science education and a language education faculty member. The faculty members stated that the reason for the closed-ended questions such as "...does it exist?" should be questioned and explained. For this reason, questions such as "... explain the reason for your opinion." or "... what do you think? Why?" were added to the questions. The six-question form was shared with pre-service teachers on an online platform. The response period was uniformly limited to five days for all participants to ensure consistency across the data collection process. All participants were informed of this fixed deadline in advance. Although the form automatically closed after five days, this controlled window was applied equally and transparently, minimizing potential uncontrolled variation.

Detailed Opinion Form

After the activity of preparing texts with scientific content, a detailed opinion form was applied to obtain the opinions of nine pre-service teachers about reading comprehension and texts with scientific content in science education. In the preliminary opinion form, four main categories related to reading comprehension and scientific texts in science education were included: (1) the importance of reading comprehension in science education, (2) the inclusion of reading comprehension in educational content, (3) the preparation of scientific texts, and (4) the evaluation of reading comprehension. For each of these categories, one or two open-ended questions were developed, resulting in a total of six questions in the preliminary form.

In the detailed opinion form, two additional categories were introduced based on pre-service teachers' perspectives: (5) needs and self-efficacy perceptions regarding reading comprehension in science education, and (6) practical competencies for integrating reading comprehension into science instruction. Moreover, the detailed form included multiple open-ended questions under each category, resulting in a comprehensive instrument consisting of 17 questions in total.

The questions in the detailed opinion form were developed by the researchers through a review of relevant literature, consultation with field experts, and an examination of existing scales related to reading strategies and reading self-efficacy. Key sources used during this process included the "Reading Strategies Scale" developed by Coşkun (2011) and the "Critical Reading Self-Efficacy Perception Scale" developed by Karabay (2013).

As a result of the analysis of the data obtained from the questions in the detailed opinion form, findings were organized under the themes of the importance of reading comprehension in science education, needs and competencies related to reading comprehension processes, and the effect of scientific texts on reading comprehension. These themes were developed based on the six thematic areas included in the detailed opinion form.

The validity of the questions was evaluated by a science education and a language education faculty member and the elaboration of each theme and question wording were deemed appropriate. The detailed opinion form categories were shared with pre-service teachers. The response period of the form was set as five days, and the questions were closed for response when the time expired.

Data Analysis

In this study, codes were determined for the answers given by pre-service teachers to the opinion forms and analyzed according to the categories in which the codes clustered. The data were analyzed by a content analysis method. Preliminary interview form data were presented with graphs. The detailed interview form data were turned into tables. The codes were examined independently by the researchers and tabulated in their final form.

Validity and Reliability

Various strategies were implemented to ensure the validity and reliability of the study. First, participant confirmation was obtained, consensus was reached among the researchers during data analysis, the data were contextualized and enriched with direct quotations, and expert opinions were consulted during the development of data collection tools (Creswell,

2013). The voluntary participation of the participants was also taken into account in terms of ethical validity.

To ensure the validity and reliability of the qualitative data analysis, a systematic and transparent coding process was followed. Participant statements were carefully examined in relation to the research questions and matched with appropriate codes. For instance, the statement *“Science texts contain information that contributes to science lessons and this information contributes to students' understanding”* was categorized under the code *“understanding/learning science concepts”*, as it highlights the contribution of scientific texts to students' comprehension of scientific concepts. Each statement was interpreted within its context, associated with relevant codes, and grouped under broader thematic categories.

During data analysis, the independent codings conducted by the researchers were compared; discussions were held on overlapping themes, and a high level of agreement was reached regarding the code clusters. To enhance the transferability (generalizability) of the findings, detailed information was provided about the participants and the research context, and the data were supported with direct quotations.

To ensure intercoder reliability, a randomly selected portion of the data was independently coded by two researchers. The consistency between coders was calculated using the approach proposed by Miles and Huberman (1994), and the intercoder agreement rate was found to be 96.15%. This high level of agreement indicates strong coding reliability. All of these procedures were implemented to support the credibility, confirmability, and dependability of the findings.

Results

Pre-service Science Teachers' Views on Reading Comprehension and Scientific Texts

The findings obtained as a result of the pre-interview form applied to reveal the views of pre-service science teachers about reading comprehension in science education and texts with scientific content were presented in this section. Pre-service science teachers' views on reading comprehension in science education were grouped under four categories. Each category is given in the graphs with the codes assigned and the frequencies of the codes respectively. The first category, the views on the importance of reading comprehension in science education is given in Figure 2.

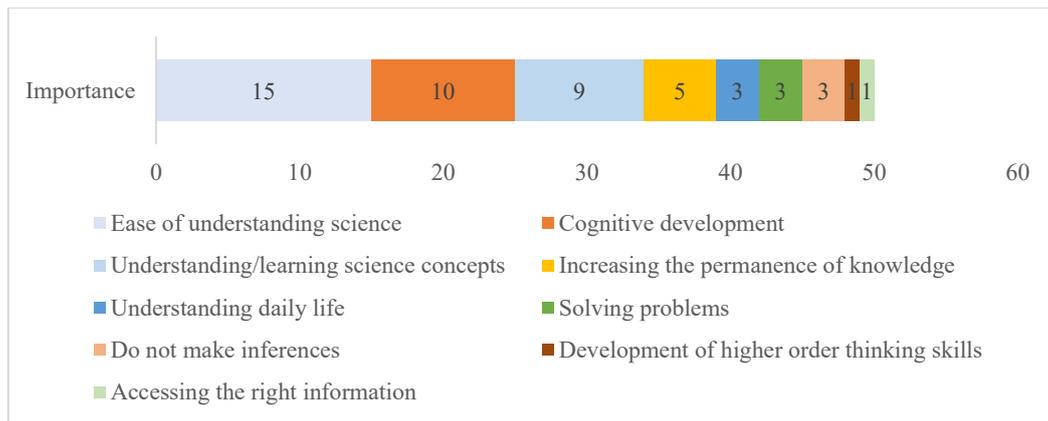


Figure 2 Opinions on the Importance of Reading Comprehension in Science Education

In the answers related to this category, it was stated that the most important role of reading comprehension in science education is “facilitating the understanding of science concepts and science” ($f=15$) and “providing cognitive development” ($f=10$). The following answers can be given as examples for two frequently seen codes.

“...Science texts contain information that contributes to science lessons and this information contributes to students' understanding.” (TC23)

“...texts with scientific content make a great contribution to the child both at the level of knowledge and mental development.” (TC5)

The second category in which pre-service teachers' views on reading comprehension in science education are clustered is the category on how to include reading comprehension in science education. The opinions related to this category are presented in Figure 3.

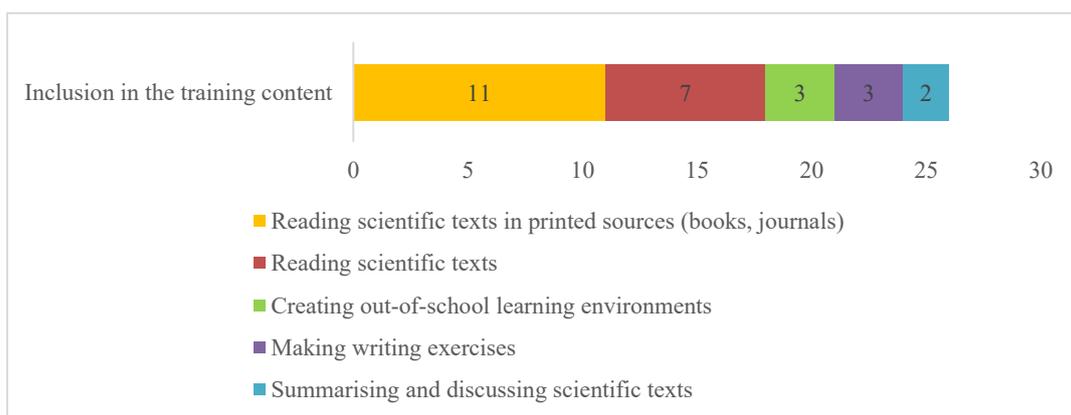


Figure 3 Opinions on the Inclusion of Reading Comprehension in Educational Content

In Figure 3, the most common way expressed by pre-service teachers is “reading texts from printed sources in science lessons” ($f=11$) regardless of whether the content is related to science or not. The second most frequent response was that “reading the scientific text” ($f=7$),

regardless of whether it is a printed or online source, is a way to use reading comprehension in science lessons. Examples of the two most common codes are given below.

“I definitely think that the only way to understand not only science education but also all texts in general is to read a lot of books” (TC11).

“...If students read texts with science content, they can understand and interpret the texts they read better.” (TC6)

The views of the pre-service teachers on how scientific texts are prepared as a way of using reading comprehension in science education constitute the third category. The opinions related to this category are presented in Figure 4.

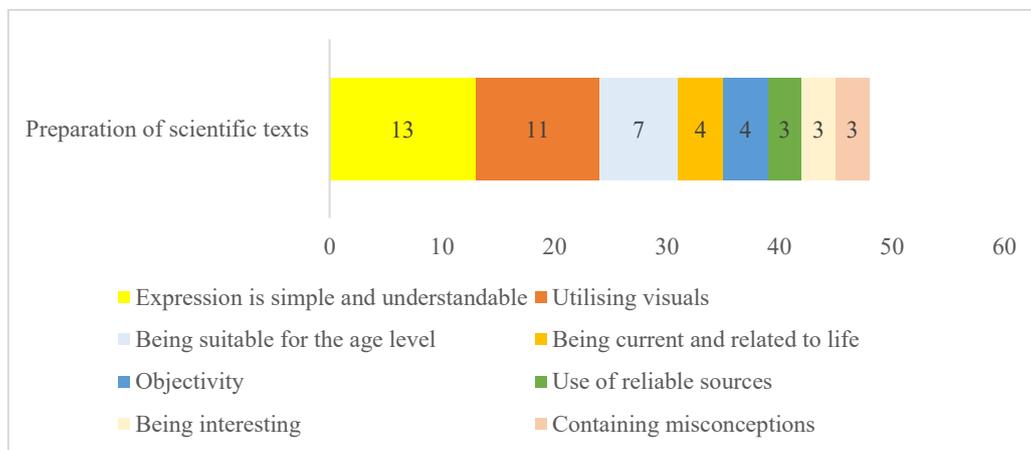


Figure 4 Opinions on the Preparation of Scientific Texts

Regarding the preparation of scientific texts, pre-service teachers gave the most common answers as “Narration should be simple and understandable” (f=13) and “Utilizing visuals” (f=11). Examples of the two most common codes are given below.

“It shouldn’t go into too much detail...” (TC22)

“Visuals can be included...” (TC13)

The fourth category in which pre-service teachers put forward their views on how to evaluate reading comprehension is evaluation. The opinions related to this category are presented in Figure 5.

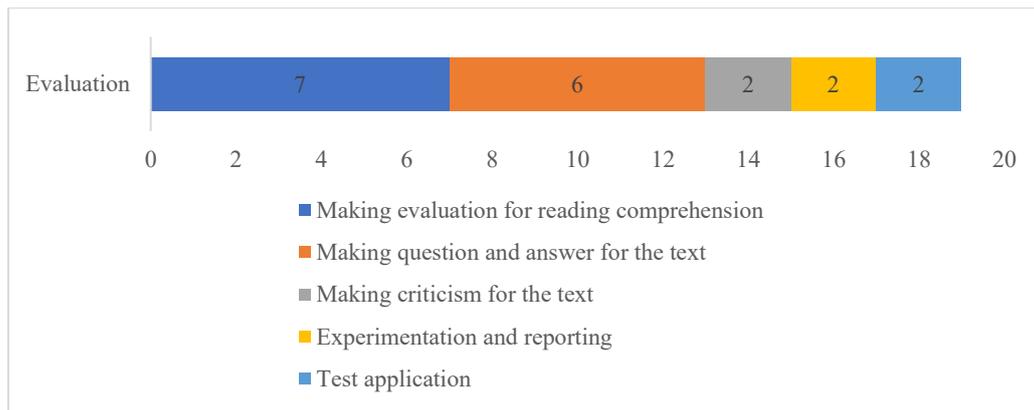


Figure 5 Opinions on Evaluating Reading Comprehension

In this category, “making evaluations” ($f=7$) and “making questions and answers about the text” ($f=6$) come to the fore in general. Examples of the two most common codes are given below.

“In order to test whether the student understands what he/she reads, questions can be asked and feedback can be received, or the information he/she reads can be demonstrated in practice, or the book can be explained by simplifying the sentences...” (TC21)

“Creating text content according to their level and having students answer questions related to the text...” (TC25)

Pre-service Science Teachers’ Reflections on Reading Comprehension, Scientific Texts, and Related Competencies Following Instructional Design Activities

Findings related to the research question “What are the opinions of pre-service science teachers about the process of preparing a text activity with scientific content?” are given. The views of pre-service science teachers regarding the importance of reading comprehension in science education are presented in Figure 6.

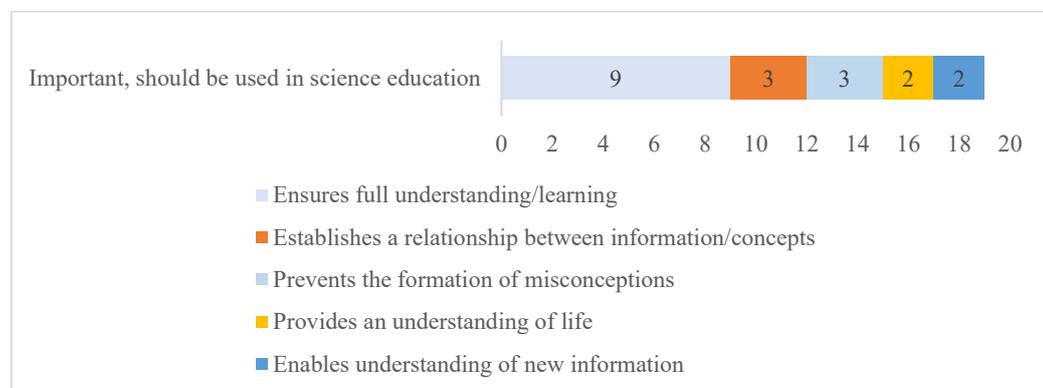


Figure 6 The Importance of Reading Comprehension in Science Education

Pre-service science teachers think that reading comprehension in science education is important in terms of “ensuring full understanding/learning (f=9), establishing a relationship between information/concepts (f=3) and preventing misconceptions (f=3). Examples of the two most common codes are given below.

“Yes, I do. Because without reading comprehension, the subject would not be learned completely. It was learned incompletely or with misconceptions.” (TC8)

“I think it is important because the subjects in science education are interrelated and more complex, so I think science education will not be effective without making sense.” (TC6)

Pre-service science teachers' views on scientific content texts were examined under two categories: “Requires a good preparation process” as presented in Figure 7 and “Scientific texts are different from concept stories” as presented in Figure 8.

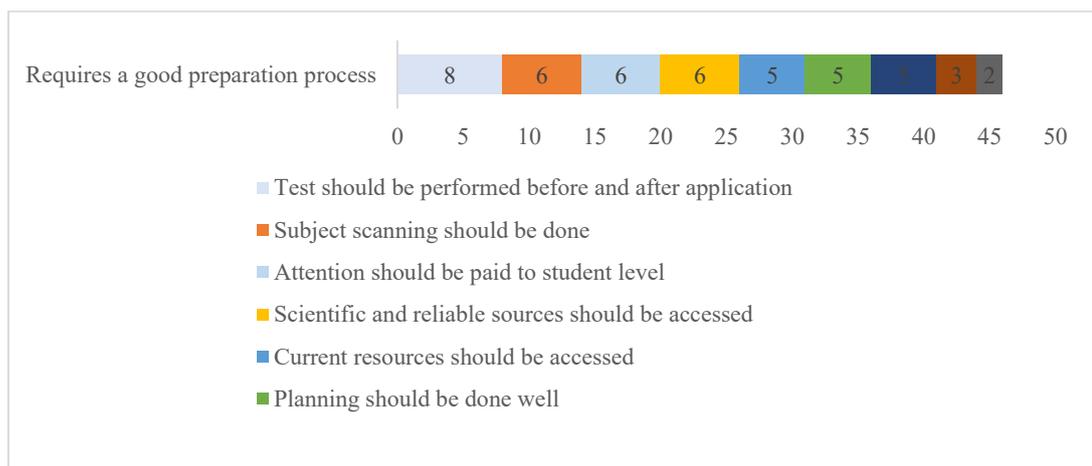


Figure 7 Characteristics of Texts with Scientific Content: Requires a Good Preparation Process

Regarding the characteristics of texts with scientific content, pre-service science teachers think that they require a good preparation process and that scientific texts are different from concept stories. Regarding the need for a good preparation process in the preparation of scientific texts, the most common answers were “The test should be applied before and after the application” (f=8), “Subject scanning should be done”, “Student level should be considered”, “Scientific and reliable sources should be accessed” (f=6). Examples of the two most common codes are given below.

“Before applying the scientific text, I ask questions about the subject. I try to record these answers as much as possible. Then I apply the same questions after I give the scientific text.” (TC1)

“I ensure that the sources are reliable. I use journals and scientific articles as sources.”
(TC3)

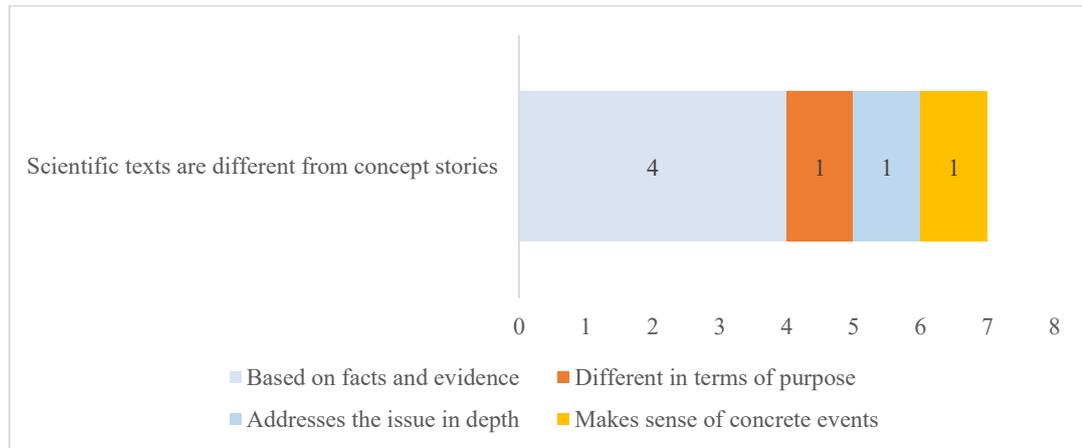


Figure 8 Characteristics of Texts with Scientific Content: Scientific Texts Are Different From Concept Stories

Regarding the difference between scientific texts and concept stories, the most common opinion was “It is based on facts and evidence” ($f=4$). The views of pre-service science teachers on improving reading comprehension in science education are presented in Figure 9.

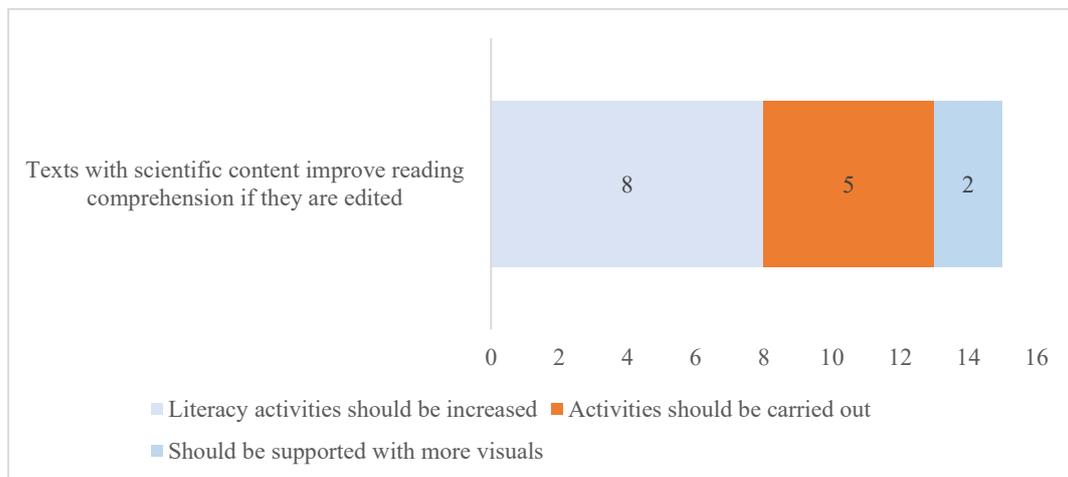


Figure 9 Improving Reading Comprehension

Pre-service science teachers think that if necessary arrangements are made in texts with scientific content, it will improve reading comprehension. For this the majority suggested “Increasing literacy activities” ($f=8$). Examples of the most common code are given below.

“...When we read like other texts, our vocabulary memory improves and our reading comprehension improves even if we don’t realize it.” (TC10)

The views of pre-service science teachers on the evaluation of reading comprehension in science education are presented in Figure 10.

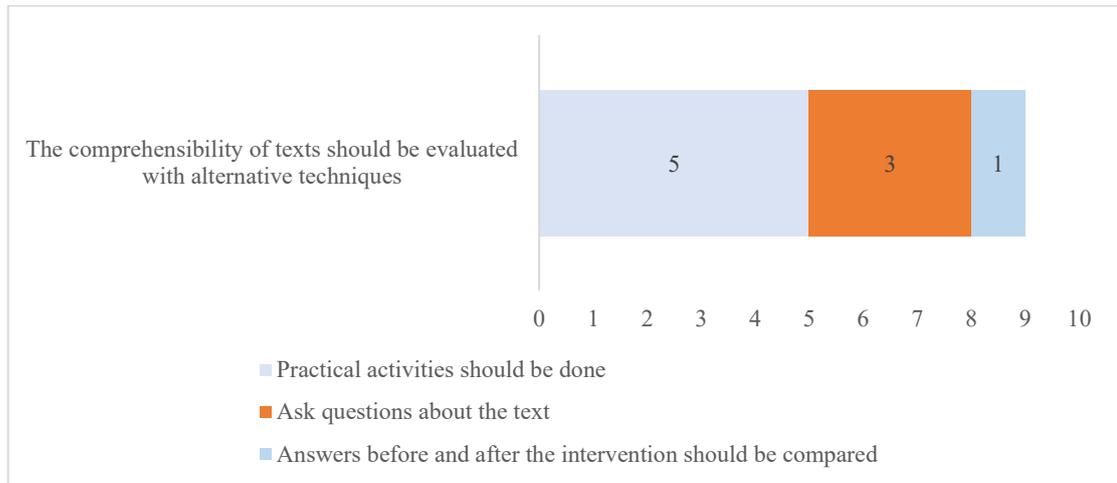


Figure 10 Evaluation of Reading Comprehension

In order to evaluate reading comprehension, it is thought that the comprehensibility of the texts should be evaluated with alternative techniques (f=8). These alternative techniques were expressed as doing practical activities (f=5) and asking questions about the text (f=3). Examples of the two most common codes are given below.

“I would ask them to write a text close to the same text.” (TC4)

“I ask small, short, understandable questions. I understand how much they have learned by practicing.” (TC9)

The views of pre-service science teachers on improving their reading comprehension skills through scientific content texts are presented in Figure 11.

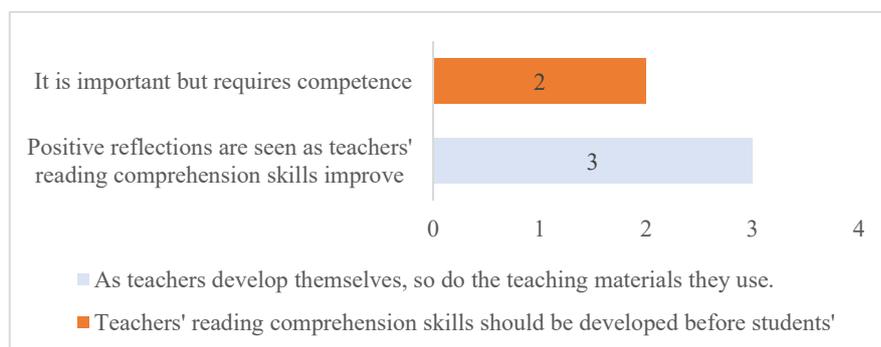


Figure 11 Teachers' Improvement of Reading Comprehension Skills with Scientific Content Texts

It is thought that improving teachers' reading comprehension skills with scientific texts will cause positive reflections with the development of the teaching materials they use (f=3).

In addition, it was stated that this situation is important, but teachers should improve their reading comprehension skills and become proficient ($f=2$). Examples of the two most common codes are given below.

“Teachers are professionals in their fields. Their contribution is high as long as they improve themselves.” (TC4)

“It is very important. If teachers understand what they read, it will be easier for them to transfer it to students.” (TC1)

The views of pre-service teachers regarding their competencies for incorporating reading comprehension into science education are presented in Figure 12.

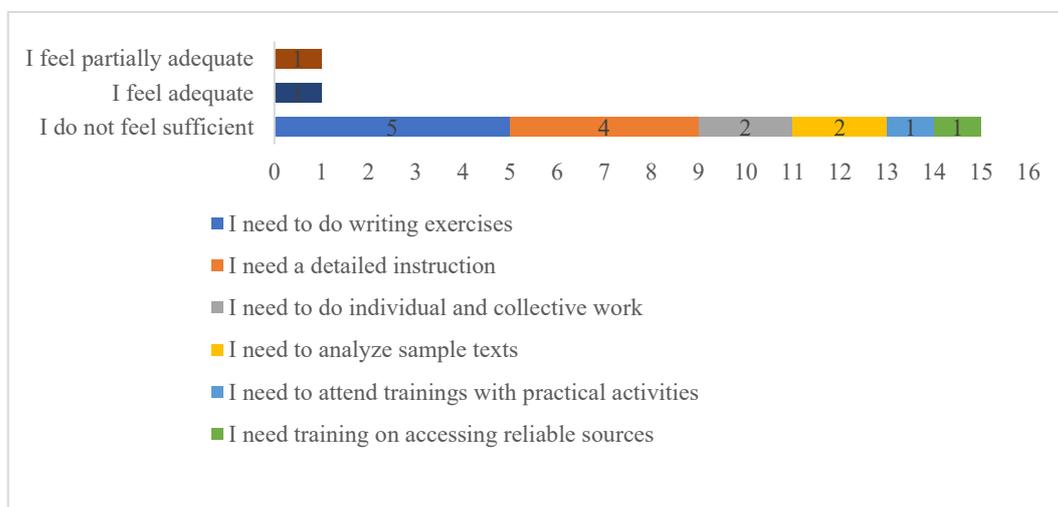


Figure 12 Pre-service Teachers' Competencies for Incorporating Reading Comprehension into Science Education

It is seen that pre-service science teachers do not feel competent in including reading comprehension in science education ($f=7$). It is seen that pre-service science teachers who do not feel competent in this regard need to do writing activities ($f=5$), to provide detailed instructions ($f=4$), to do individual and collective activities ($f=2$) and to analyze sample texts ($f=2$). Examples of the two most common codes are given below.

“Stories can be read, various literary texts can be read.” (TC9)

“Teacher candidates should be informed about this subject and seminars should be organized on the subject.” (TC6)

Conclusions and Suggestions

In this study, pre-service science teachers' views on reading comprehension and scientific texts in science education were examined. According to pre-service science

teachers, reading comprehension in science education provides cognitive development, improves comprehension and increases the retention of knowledge. In this respect, it is seen that the views of pre-service teachers are similar to the studies (Cromley, 2009) that reading comprehension success positively affects science achievement. As a matter of fact, it is known that reading activities in the lessons contribute to the structuring of knowledge and comprehension of science since they enable activation of prior knowledge, consolidation and elaboration of learned knowledge (Broncano et al., 2011). Because of these benefits, pre-service science teachers have a positive tendency to include reading comprehension activities in science education. They think that this can be realized by reading printed sources (books, journals), reading scientific texts, doing writing activities and evaluating reading comprehension with various techniques. It is stated that reading scientific texts (Shanahan & Shanahan, 2008) and experiencing literacy practices (Wellington & Osborne, 2001) are necessary for reading comprehension. Among all these recommended practices, since teachers have limited resources to support the integration of science and literacy (Freeman & Taylor, 2006), the views on the preparation of scientific texts are considered to be of particular importance. According to pre-service science teachers, in the preparation of these scientific texts, attention should be paid to the simplicity and comprehensibility of the narration, the use of visuals, and the appropriateness for the age level. While there are views that science texts should be more information-oriented and explanatory compared to other text types (Reid & Hodson, 1987), over time, scientific texts have been made more interesting (Lunzer & Gardner, 1979). With this changing approach, since scientific texts are conceptually complex, cognitively and linguistically challenging (Rojas Rojas et al., 2019) and less motivating and less interesting than other types of reading (Wellington & Osborne, 2001), it can be said that these criteria expressed by pre-service science teachers are important for scientific texts to be effective in reading comprehension. It is also known that the appropriate preparation and use of science texts at the secondary school level motivates students to read these texts (Binns et al., 2020). Teachers can see reading comprehension trainings, techniques, and activities as an important strategy to encourage reading with science content, and in this way, they can give the responsibility of teaching reading skills with scientific content to their students (Yore, 1991).

Based on the results of this study, it is seen that pre-service science teachers have positive views on the development of reading comprehension and the use of texts with scientific content in science education. Based on their own experiences, pre-service science

teachers who designed activities according to the process of preparing texts with scientific content emphasized that text activities with scientific content require a good preparation process. In this preparation process, it was stated that it was necessary to pay attention to issues such as applying tests before and after the application, reviewing the topic, taking into account the level of students, accessing scientific, reliable and up-to-date resources, ensuring good planning and ensuring that the prepared text does not create misconceptions. The results of this study coincide with the results of studies (Sayın & Takıl, 2023), which state that the use of various sources in the creation of scientific texts, the identification of new knowledge and important concepts related to the reading text, the standards on how to teach these knowledge and concepts, the content and evaluation methods should be well planned. As a matter of fact, it is important to make good planning in the creation of texts with scientific content that contain appropriate concepts and relationships between concepts and enable students to question the events in the text with their science skills. In this respect, it is necessary to utilize reliable sources and to create a text suitable for the level of the student and the purpose of teaching. Based on this text, reading comprehension questions that utilize different skills should be added to the scientific text.

In the study, the opinions of the pre-service teachers about the effect of scientific texts on reading comprehension were that it would be possible for scientific texts to improve students' reading comprehension if teachers have sufficient reading comprehension skills. Supporting these views, Begum and Hamzah (2018) found that teachers' self-efficacy towards reading comprehension affects students' reading comprehension skills. Along with these results, there are study results in the literature that teachers have poor comprehension of texts with scientific content (Baltacı, 2021). Students have cognitive and linguistic difficulties in reading in science courses (Rojas Rojas et al., 2019) and have difficulty in defining scientific phenomena (Rop, 2003). Again, one of the results obtained in this study is that pre-service science teachers do not feel competent in reading comprehension. They expressed their opinions about their self-efficacy by stating that they needed sample texts, instructions, individual and collective work, training with activities and writing activities. According to Morales (2014), even if teachers believe that reading instruction is important and even necessary for science learning, they may avoid using reading in science instruction if they do not feel competent in helping students become stronger readers of science texts. It is known that teachers' self-efficacy for reading and reading comprehension is important for integrating

reading into instruction, and the more equipped teachers feel, the more likely they are to use reading approaches and strategies (Cantrell & Callaway, 2008; Cantrell & Hughes, 2008).

In this direction, it is recommended to provide both pre-service and in-service teachers with training opportunities that enable them to gain knowledge about scientific texts and improve their reading comprehension skills (Benzer, 2016; Feez & Quinn, 2017; Rojas Rojas et al., 2019; Yore et al., 2003). It is necessary to develop structured modules that explicitly teach reading strategies related to scientific texts, include hands-on activities using authentic scientific materials, and incorporate reflective practices that allow teachers to review and revise their own instructional materials and approaches. To ensure continuity in professional development, it is important to establish mentoring systems in which experienced teachers guide novice teachers. Furthermore, it is recommended to develop assessment tools that can monitor teachers' progress in scientific literacy and reading comprehension pedagogy, and to utilize these tools systematically. Creating open-access digital repositories that include scientific texts and lesson plans appropriate to different grade levels is also essential for supporting teachers' access to reliable materials.

Finally, encouraging teachers to participate in action research on reading comprehension in the context of science education may enhance their understanding of student needs and foster practical professional growth.

Compliance with Ethical Standards

Disclosure of potential conflicts of interest

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Research involving Human Participants and/or Animals

Ethics committee approval has been obtained from Marmara University, Institute of Educational Sciences Research Ethics Committee with the number of 24.02.2022/02-9. This study has been performed in accordance with the ethical standards.

Fen Bilgisi Öğretmen Adaylarının Okuduğunu Anlama ve Bilimsel İçerikli Metinler Hakkındaki Görüşleri

Özet:

Günümüzde, fen eğitiminde okuduğunu anlama uluslararası fen eğitimi hedeflerine ulaşmak için önemli bir beceri olarak görülmektedir. Bu bağlamda fen bilgisi öğretmen adaylarının bu konudaki yeterliliklerinin ve görüşlerinin incelenmesi daha da önemli hale gelmektedir. Bu çalışma, fen bilgisi öğretmen adaylarının fen eğitiminde bilimsel içerikli metinlerin ve okuduğunu anlamının önemine yönelik görüşlerinin incelenmesini hedeflemektedir. Araştırmada, nitel araştırma yöntemi desenlerinden durum çalışması kullanılmıştır. Fen bilgisi öğretmen adaylarının bilimsel metinler ve okuduğunu anlama hakkındaki görüşleri açık uçlu sorulardan oluşan görüş formu ile alınmıştır. Görüşler alındıktan sonra öğretmen adaylarına bilimsel metinler ve okuduğunu anlamının değerlendirilmesinde kullanılan stratejiler hakkında bir seminer verilmiştir. Bu seminerin sonunda öğretmen adaylarından ortaokul öğrencileri için bir bilimsel metin ve metinden hareketle okuduğunu anlama sorularını içeren için bir etkinlik tasarımları istenmiştir. Etkinlik tasarımından sonra öğretmen adaylarından gönüllü olan ve etkinlikleri tasarlama farklı başarı gösteren 9 öğretmen adayının detaylı görüş formu ile tekrar görüşleri alınmıştır. Çalışmanın sonuçlarına göre fen bilgisi öğretmen adaylarının fen eğitiminde okuduğunu anlamaya ilişkin bilişsel gelişimi sağladığı, kavramsal anlamayı geliştirdiği ve bilginin kalıcılığını arttırdığı yönünde görüşleri vardır. Fen bilgisi öğretmen adaylarının fen eğitiminde okuduğunu anlamının önemine dönük olumlu eğilimlerinin olduğu; bu amaçla kullanılan bilimsel metinlerin sade, anlaşılır, görsellerle desteklenmiş ve değerlendirme etkinlikleri içerecek şekilde tasarlanması gerektiğini düşündükleri belirlenmiştir.

Anahtar kelimeler: Okuduğunu anlama, fen eğitimi, bilimsel içerikli metinler, fen bilgisi öğretmen adayları.

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