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Author Contribution Statement

[1] **Gülşah Zerman KEPCEOĞLU**
Graduate Student
Kastamonu University, Turkey

Literature review, application, data analysis, review-writing

[2] **Serhat İREZ**
Prof.Dr
Marmara University, Turkey

Conceptualization, methodology, review-writing and editing

Abstract

Many science educators have expressed the role and importance of the history of science in promoting scientific literacy. It is generally acknowledged that students should understand the social and cultural structure of science knowledge, in which students learn not only the concepts and principles offered by science but also the application areas of the information provided by science and the scientific knowledge they have created. From this point of view, the history of science emerges as a potential resource and a meaningful teaching strategy that can be used both in the teaching of scientific content and the nature of science. On the other hand, it is clear that textbooks are one of the essential components of science education, given their role in education. Textbooks are the primary source of information in the learning environment. It is the most important educational resource for students outside and beyond the teacher, and for the teacher, it is often the representative of the teaching program. Many teachers, especially novice teachers, construct the content and course of lessons according to the textbooks in their hands. From this point of view, this study investigates how much history of science is integrated in high school textbooks. For this purpose, appropriate textbooks (grades 9-12) taught by the Ministry of Education (MoNE) as a textbook in high school were examined. A qualitative research approach was followed in the study and document analysis was chosen as the study design. When each course book is examined, the sections containing the science history information are identified and taught carefully read. The quality of these sections in learning and teaching has been analyzed. Of the analyses, a scoring key was used, which allows scoring using a total of 13 criteria in conceptual, procedural, and contextual areas of the quality of science historical stories. As a result of the research, the history of science for conceptual, procedural, and contextual understanding has been included in high school chemistry textbooks, but this use is limited. While more importance is attached to scientific history for procedural understanding in books, it has been found that the use of the history of science is worthless for conceptual and contextual understanding.

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Research Article

An Analysis of the Place of the History of Science in Chemistry Textbooks *

Gülşah Zerman KEPCEOĞLU [1], **Serhat İREZ** [2]

Abstract

Many science educators have expressed the role and importance of the history of science in promoting scientific literacy. It is generally acknowledged that students should understand the social and cultural structure of science knowledge, in which students learn not only the concepts and principles offered by science but also the application areas of the information provided by science and the scientific knowledge they have created. From this point of view, the history of science emerges as a potential resource and a meaningful teaching strategy that can be used both in the teaching of scientific content and the nature of science. On the other hand, it is clear that textbooks are one of the essential components of science education, given their role in education. Textbooks are the primary source of information in the learning environment. It is the most important educational resource for students outside and beyond the teacher, and for the teacher, it is often the representative of the teaching program. Many teachers, especially novice teachers, construct the content and course of lessons according to the textbooks in their hands. From this point of view, this study investigates how much history of science is integrated in high school textbooks. For this purpose, appropriate textbooks (grades 9-12) taught by the Ministry of Education (MoNE) as a textbook in high school were examined. A qualitative research approach was followed in the study and document analysis was chosen as the study design. When each course book is examined, the sections containing the science history information are identified and taught carefully read. The quality of these sections in learning and teaching has been analyzed. Of the analyses, a scoring key was used, which allows scoring using a total of 13 criteria in conceptual, procedural, and contextual areas of the quality of science historical stories. As a result of the research, the history of science for conceptual, procedural, and contextual understanding has been included in high school chemistry textbooks, but this use is limited. While more importance is attached to scientific history for procedural understanding in books, it has been found that the use of the history of science is worthless for conceptual and contextual understanding.

Keywords: History of science, textbook, chemistry education

1. INTRODUCTION

The development of scientific literacy is among the main objectives of science education. Scientific literacy has come to cover many purposes of science teaching (Laugksch, 2000). In today's chemistry curriculum, the acquisitions that allow students to acquire general scientific and chemistry literacy are included (Ministry of National Education [MoNE], 2013). It is assumed that scientifically literate individuals can understand the nature of science and scientific knowledge, fundamental scientific concepts, principles, laws, and theories and use them appropriately (MoNE, 2013).

Many methods, such as inquiry-based learning, problem-based learning, argumentation, and -scientific issues, have been introduced to actively involve students in scientific activities in educational contexts similar to scientists' social and cultural contexts and to provide them with new understandings of scientific literacy (Köseoğlu, Tümay & Budak, 2008). Along with these, one of the critical approaches that can be used in gaining scientific literacy is the historical approach.

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[1] *Graduate Student, Kastamonu University gulsahzerman@hotmail.com, Kastamonu, Turkey*

[2] *Prof. Dr., Marmara University, sirez@marmara.edu.tr, İstanbul, Turkey*

Corresponding Author e-mail adress: gulsahzerman@hotmail.com

The history of science is the story of the birth and development of scientific thought, culture, and all mental activities of human beings (Doğan & Özcan, 2010). The history of science is the story of an exciting adventure about where the history of humanity started and where it reached (Erdem, 2005). Again, according to Erdem (2005), the achievements of scientists, the difficulties they experienced, and the imagination that inspired inventions are essential milestones in this story. History of science is a discipline that should be taught at every education level, as it fills a significant gap in understanding the nature of science, as successes enable people to know what happened in the past and shed light on the scientific developments of today and the future (Doğan & Özcan, 2010). It is claimed that teaching science with a historical approach will contribute to the successful learning of both the concepts of the nature of science and the subject area (Ayvacı, 2007). The historical approach encourages students to learn how scientific ideas emerged in the social and cultural context and how scientific developments progressed from past to present in a historical development order (McComas & Oslon, 2000); cited in (Doğan & Özcan, 2010). In addition, through the history of science, when students understand how scientific knowledge develops and how the historical, philosophical, and technological context affects this development, they will have a more comprehensive view of science. Therefore, they will be more interested in science learning (Jussi & Gilbert, 2000); cited in (Laçin & Şimşek, 2011).

Poincare (1989) argues that the nature of science can be explained by looking at the history of science, while Kuhn (2008) argues that science cannot be taught without explaining the history of science. However, it is stated that the history of science should not be seen only as a timeline and a narrative warehouse (Kuhn, 2008) and that the history of science is not a story of discovery (Sarton, 1995). At the same time, it was pointed out that the discoveries are temporary and that new ones will replace the old ones (Sarton, 1995). In this context, a scientist interested in the history of science is not responsible for keeping a record of inventions or discoveries but for explaining the development of thought according to science. Individuals observing the changes in the history of science can realize how scientific developments are. In this respect, it can be said that the history of science is quite suitable for use in science education (Laçin-Şimşek, 2009).

The use of the history of science in science teaching contributes to the development of students' understanding of the nature of science (Ayvacı, 2007; Craft & Miller, 2007; Lin & Chen, 2002; Irwin, 2000; Klopfer & Cooley, 1963), creating an image of science and scientist (Matthews, 1994; Şeker, 2012; Şen-Gümüş, 2009), increasing their interest in lessons (Solbes & Traver, 2003; Şeker & Welsh, 2006) and learning concepts (Ayvacı, 2007; Stinner & Williams, 1993). In addition, using the history of science in science education helps students acquire a science culture (Güney & Şeker, 2012). The concept of scientific culture defines the values involved in the change and development of science, its effects on society, and the place people working for this purpose take in society. Students' putting themselves in the place of a scientist can be given as an example of empathy established with scientific culture (Güney & Şeker, 2012).

On the other hand, textbooks are one of the most critical tools in effectively bringing the history of science to the classroom environment. A textbook is the essential educational element that explains the information on the subjects in the relevant curriculum in a particular order and plans and guides students and teachers towards the achievements of the course (Ünsal & Güneş, 2004). It is seen that elements related to the history of science are not included sufficiently in textbooks, which are among the written and visual materials most used by students (Kahraman, 2013; Kılıç, 2010; Yıldız, 2013). In addition, while textbooks include statements about the conceptual structure of science, statements about scientific methods and processes are less common (Laçin-Şimşek, 2009). Designing curriculum materials that only emphasize conceptual understanding is insufficient for students to learn science and the nature of science (McNeill, Lizotte, Krajcik & Marx, 2004).

For this reason, it should be stated not only what the information is in the textbooks but also how it was accessed over time (Gallagher, 1991). In this context, this study aims to reveal how much and how much space is included in the history of science in high school chemistry textbooks and to investigate the adequacy of the current usage. This study will examine how much space is included in the history of science in high school chemistry textbooks and how the history of science is used. Within the framework of this primary purpose, answers were sought to the following sub-questions:

1. How much space is given to the history of science in high school chemistry textbooks?
2. How is the history of science integrated in high school chemistry textbooks?
3. What are the characteristics of the sections on the history of science in high school chemistry textbooks?
4. Are the sections on the history of science included in high school chemistry textbooks balanced throughout the book?

2. METHOD

2.1. Research Model

In this study, a qualitative research approach was adopted in connection with the research question. Qualitative research is research in which qualitative data collection methods such as observation, interview, and document analysis are used, and a qualitative process is followed to reveal perceptions and events in a natural environment realistically and holistically (Yıldırım & Şimşek, 2008). In this research, using document analysis, one of the qualitative research design methods, high school chemistry textbooks (9^{th}, 10^{th}, 11^{th}, and 12^{th}-grade textbooks) approved by the Ministry of National Education and free for students as textbooks in Kastamonu province were examined. Document analysis includes the analysis of written materials containing information about the case or cases that are aimed to be investigated (Yıldırım & Şimşek, 2008). Content analysis of documents, which have an essential place in social trends, historical documents, and cultural studies, has started to be used in parallel with the search for multiple methods in educational research (Çeken & Eş, 2013).

2.2. Determination of Textbooks

Teaching tools are needed for teaching to take place. Instructional tools fulfill the most extreme function in acquiring the necessary behavior of the learners. In this context, teaching tools are used to ensure that learning takes place on time, that it is permanent, and that the learning environment is formed healthily (Kılıç, 2010). Conversely, books are one of the most essential tools and materials that help students in education (Duman & Çakmak, 2004). Textbooks are the most widely used among books. Textbooks are the primary documents that examine and explain the information on the subjects in the curriculum in a planned and regular way and guide and train the students in line with the course's objectives as a source of information (Ünsal & Güneş, 2004).

Qualifying a book as a textbook means that it coincides with the curriculum of the relevant course. Therefore, the textbook is suitable for applying the strategies, methods, and techniques required by the program's goals and behaviors (Kılıç, 2010). One of the critical factors affecting the program's success in education programs is the textbooks. In this respect, textbooks are the primary material that builds a bridge between the program and the student (Demirel & Kıroğlu, 2005). When we look at it from these perspectives, we can see the textbook as one of the complementary elements of the program.

Textbooks are a resource that determines what students will learn and what teachers will teach during teaching. They also have essential effects on decisions regarding classroom learning and teaching activities. In general, many teachers determine the course's objectives, the tests to be applied to the students, the teaching strategies, and the assignments according to the textbooks used.

It is essential to choose the textbooks to be examined in studies where textbooks are examined in different dimensions. This study selected four chemistry textbooks approved by the Ministry of

National Education to be used as textbooks in high school chemistry courses and distributed free of charge to students. Information about these books is included in Table 1.

Table1. Textbooks reviewed

Class	Writer	Publication Year	Printing house	ISBN
9th grade	Commission	2015	MEB	978-975-11-3770-8
10th grade	Commission	2015	MEB	978-975-11-3919-1
11th grade	Commission	2015	MEB	978-975-11-3386-1
12th grade	Commission	2015	MEB	978-975-11-3571-1

2.3. Review Criteria

After the selection of the textbooks to be examined, a literature review was conducted to determine according to which criteria the history of science texts in the books would be examined. As a result of the literature review, it has been determined that the best scale that can be used to evaluate the use of the history of science in textbooks is the "History of Science Instructional Scale" developed by Wang and Marsh (2002) in 2002 and adapted into Turkish by Yıldız (2013). The scale is presented in Table 2.

Table 2. History of science instructional scale

Size Name	History of Science Instructional Scale	Points 1	2	3	4	5
History of Science for Conceptual Understanding	Helping students learn scientific content and ideas					
	Helping students learn scientific model explanations					
	Helping students learn scientific explanations, theories, and laws					
	Helping students understand the volatile nature of scientific knowledge					
	Helping students develop their systematic thinking skills					
History of Science for Procedural Understanding	Helping students develop their habit of asking questions					
	Helping students increase their research habits (observation, measurement, evaluation, etc.)					
	Helping students see the purpose, motivation, and motivation in connecting scientific studies					
	Help students understand how scientific endeavors, social factors, and political forces are closely related.					
History of Science for Contextual Understanding	Help students understand how scientific research affects human well-being.					
	Help students understand that scientists also function in a community where others produce knowledge through their efforts.					
	Help students understand that scientists are also individuals and human beings.					
	Helping students recognize the distinction between cultural heritage and role models					

Within this scale, the history of science is divided into three main frameworks: conceptual, procedural, and contextual understanding. From these frameworks, conceptual understanding consists of four criteria, procedural understanding consists of three criteria, and contextual understanding consists of six criteria. For each criterion, a Likert-type scoring key was created to give a score between 1 and 5 (5 representing perfect, 4 good, 3 medium, 2 passing, and 1 poor score). At the same time, as Yıldız (2003) did in his study, separate keywords were given for each of the analyzed criteria

for ease of analysis. In addition, if there is no information about any of the criteria examined in the history of science stories in the books examined, zero (0) points were given to that criterion.

2.4. Data Analysis

Qualitative data analysis is a process where the researcher organizes the data, divides it into units of analysis, synthesizes it, reveals patterns, discovers essential variables, and decides which information to reflect in the report (Bogdan & Biklen, 1992); cited in (Özdemir, 2010). Miles and Huberman (1984) examine the qualitative data analysis process in a three-stage classification following each other (as cited in Özdemir, 2010). The first of these stages is the "data reduction" stage, which is collected by various techniques such as observation, interview, and document analysis; the second is the "data visualization" process; and the third is the process of "reaching and confirming the result."

Many techniques, such as Phenomenological Analysis, Content Analysis, Descriptive Analysis, Established Theory and Fixed Comparison Analysis, Discourse Analysis, and, Ethnomethodology are used in qualitative data analysis (Özdemir, 2010). In this study, descriptive analysis of these techniques was used. The description technique is the first step in explaining and understanding events, objects, and problems. This technique tries to understand and describe the "what" of events, objects, entities, institutions, groups, and various fields. Descriptive research aims to explain the interaction between current events, considering their relationships with previous events and conditions (Kaptan, 1998). According to this approach, the data obtained are summarized and interpreted according to previously determined themes. Descriptive analysis is defined by Yıldırım and Şimşek (2008) as follows:

"…The data obtained are grouped according to themes, and categories are created by giving names to each group. Direct quotes are frequently used to reflect the views of individuals interviewed or observed. This type of analysis aims to present the findings to the reader in an organized and interpreted form" (Yıldırım & Şimşek, 2008, p.33).

In this research, texts related to the history of science in the textbooks were described according to the criteria on a predetermined scale.

The examination of high school chemistry textbooks in terms of the history of science was realized at the end of a three-stage process. In the first stage, chemistry textbooks were used in secondary education institutions, and electronic versions of these books were obtained. The researcher read these books. As a result of the general examination of the textbooks, it has been determined that the parts giving information about the history of science are not included in the text and that there is information about the history of science in the parts that are primarily included as "reading text" or "reading text" and provide additional information to the lectures. For this reason, the page numbers of these textbook sections were determined, and detailed reading was started. In the second stage, the researcher read and scored the determined texts according to the criteria in the "History of Science Instructional Scale." In the third stage, another researcher took part in the descriptive analysis as the second coder to determine the reliability of the coding made by the researcher. Then, the consistency between the analyses of the two encoders was examined, and the measurement reliability coefficient between the two encoders was calculated as 0.87 using the reliability formula suggested by Miles and Huberman (1994) as Reliability = Consensus / (Agreement + Disagreement) x 100.

3. FINDINGS

3.1. Distribution of the Parts Containing the History of Science in the Textbooks by Classes

The units' names in the 9th, 10th, 11th, and 12th-grade chemistry textbooks are in the table below. These units are as follows:

Table3. Units in chemistry textbooks

Class	Units				
	Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**
9th grade	Chemical Science	Atom and Periodic System	Interactions Between Chemical Species	States of Matter	-
10th grade	Acids, Bases and Salts	Mixtures	Energy in Industry and Living Things	Chemistry is Everywhere	-
11th grade	Chemical Reactions and Energy	Reaction Rates and Chemical Equilibrium	Equilibrium in Solutions	electrochemistry	Nuclear Chemistry
12th grade	Elements Chemistry	Introduction to Organic Chemistry	Organic Reactions	Classes of Organic Compounds	-

Information about the history of science has been given more or less a place in each book examined. Information about the history of science is given at the beginning or in the lectures, in notes such as "Did you know" and "interesting point," and in sections such as evaluation questions. The information contained in these sections is usually one sentence at maximum. For example, in the first "interesting point" information of the 1st unit of the 9th-grade chemistry book, " *Hippocrates (460-370 BC) used the powder obtained from the leaves and bark of the willow tree for the treatment of febrile diseases, as a pain reliever and antipyretic* ." statement is included. Therefore, the study should have included the information in these sections.

On the other hand, in the sections called "reading text" or "reading piece" in the book, information about the history of science is given in more detail and in addition to the subject narration. Therefore, these texts were included in the study. 1 from the 9th-grade textbook, 2 from the 10th-grade textbook, 7 from the 11th-grade textbook, and 4 from the 12th-grade textbook were examined in terms of conceptual, procedural, and contextual aspects. The number distribution of the sections related to the history of science examined according to classes and units are given in Table 4.

Table4. Distribution of the sections related to the history of science examined by classes

Class	Examined Texts				
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
9th grade	0	1	0	0	-
10th grade	1	0	0	1	-
11th grade	1	2	0	0	4
12th Grade	3	1	0	0	-

3.2. Reviewing the 9th Grade High School Chemistry Textbook

The 9th-grade high school chemistry textbook consists of four units. These units are Chemistry Science, Atomic, Periodic Systems, and Interactions between Chemical Species and States of Matter. Only one reading text from the second unit was examined among these four units. In other units of the book, no section provides information about the history of science at a level that can be included in the analysis. The book consists of 220 pages. Among these pages, the number of pages containing reading texts related to the history of science and examined is 1. The scores of the reading passage in the 9th-grade high school chemistry textbook are summarized in Table 5 below.

Table5. Score table for the sections related to history of science in the 9th grade high school chemistry textbook

Dimension	Criterion	9th Class Chemistry Book 2. Unit 1. Text	Total Points	Arithmetic Average of Dimensions
Conceptual	Contents	4	4	3.75
	Model	3	3	
	Theory-Law	3	3	
	Variability	5	5	
Procedural	Thinking	5	5	5
	Asking question	5	5	
	Research	5	5	
Contextual	Connection	4	4	1.33
	social-political	1	1	
	welfare-development	1	1	
	scientific society	1	1	
	humanization	1	1	
	Common culture	0	0	
Total Points		38		
Arithmetic mean		2.9		

As seen in Table 5, the average score of the reading passage in the 9th-grade high school chemistry textbook is 3.75 in terms of conceptual understanding and the highest level in terms of procedural understanding (avg. 5). Remarkably, it can be said that the reading passage remained at a low average (mean 1.33) in terms of contextual understanding. The reading piece about the history of science in the book received total points from the "Variability," "Thinking," "Questioning," and "Research" criteria of the "History of Science Instructional Scale."

3.3. Reviewing the 10th Grade High School Chemistry Textbook

The 10th-grade high school chemistry textbook consists of four units. These units are Acids, Bases and Salts, Mixtures, Energy in Industry and Living Things, and Chemistry Everywhere. Among these four units, one reading text from the first unit and one from the fourth unit was examined. In the second and third units of the book, the section needs to include the history of science that can be included in the analysis. The book consists of 306 pages. Among these pages, the number of pages containing reading texts related to the history of science and examined is 2. The scores of the two reading passages in the 10th-grade high school chemistry textbook are summarized in Table 6. In addition, this table includes the total score and arithmetic average of each reading passage and the textbook's total score and arithmetic average for each category.

Table 6. Score table for the sections related to history of science in the 10th grade high school chemistry textbook

Dimension	Criterion	Class 10 Chemistry Book Unit 1 1. Text	4. Unit 4. Text	A.O.	Arithmetic Average of Dimensions
Conceptual	Contents	5	5	5	3,5
	Model	0	4	2	
	Theory-Law	4	3	3,5	
	Variability	3	4	3,5	
Procedural	Thinking	1	4	2.5	2.33
	Asking question	2	2	2	
	Research	1	4	2.5	
Contextual	Connection	3	3	3	2.17
	social-political	4	3	3,5	
	welfare-development	4	3	3,5	
	scientific society	3	1	2	
	humanization	0	0	0	
	Common culture	0	2	1	
Total Points		30	38		
Arithmetic mean		2,3	2.9		

As seen in Table 6, it can be said that the average score of both texts in the 10th-grade high school chemistry textbook is 3.5 in terms of conceptual understanding and below the average value of 2.5 in terms of the use of history of science in terms of procedural understanding and contextual understanding (average point of view, respectively). 2.33 and mean 2.17). In the book, two reading passages containing elements related to the history of science received total points from the "Content" criterion of the examination scale used. The second reading piece scored higher than the first reading piece in the "Model" and "Variability" criteria of the conceptual understanding dimension and the "Thinking" and "Research" criteria of the procedural understanding dimension. When the total scores of the reading pieces from the scale are compared, it is seen that the second reading piece gets a higher score.

3.4. Review of the 11th Grade High School Chemistry Textbook

The 11th-grade high school chemistry textbook consists of five units. These units are Chemical Reactions and Energy, Reaction Rates and Chemical Equilibrium, Equilibrium in Solutions, Electrochemistry, and Nuclear Chemistry. Among these five units, 1 reading text from the first unit, 2 reading texts from the second unit, and 4 reading texts from the fifth unit were examined. The book consists of 312 pages. Among these pages, the number of pages examined and containing reading texts related to the history of science is 9.

Table 7. Score table for the sections related to the history of science in the 11th grade high school chemistry textbook

Dimension	Criterion	11th Grade Chemistry Book							A.O.	Arithmetic Average of Dimensions
		Unit1	Unit 2		Unit 5					
		1.Text	2.Text	4.Text	1.Text	2.Text	3.Text	4.Text		
Conceptual	Contents	3	4	one	3	2	3	2	2.6	1.3
	Model	0	one	0	one	one	one	one	0.7	
	Theory-Law	0	one	0	one	0	0	0	0.3	
	Variability	4	4	0	2	0	0	one	1.6	
Procedural	Thinking	2	2	0	3	2	2	2	1.9	1.76
	Asking question	one	2	0	2	one	2	2	1.4	
	Research	3	2	0	3	2	2	2	2.0	
Contextual	Connection	4	4	0	2	one	2	one	2.0	0.68
	social-political	4	0	0	0	0	0	0	0.6	
	welfare-development	4	2	0	0	0	0	2	1.1	
	scientific society	3	0	0	0	0	0	0	0.4	
	humanization	0	0	0	0	0	0	0	0.0	
	Common culture	0	0	0	0	0	0	0	0.0	
Total Score		28	22	one	17	9	12	13		
Arithmetic mean		2.2	1.7	0.1	1.3	0.7	0.9	one		

As seen in Table 7, when seven reading passages containing elements related to the history of science in the 11th grade high school chemistry textbook are evaluated together, the examination scale is evaluated in terms of conceptual understanding (mean 1.3) and procedural understanding (mean 1.76) and it is at a low level in terms of contextual understanding (average 0.68). All of the reading passages in the book received partial marks from the review criteria. The average score of the 1st text with the highest score is 2.2.

3.5. Reviewing the 12th Grade High School Chemistry Textbook

The 12th-grade high school chemistry textbook consists of four units. These units are Elements Chemistry, Introduction to Organic Chemistry, Organic Reactions, and Organic Compound Classes. Within these four units, 3 from the first and 1 from the second units, reading texts related to the history of science were examined. The book consists of 334 pages. Among these pages, the number of pages containing reading texts related to the history of science and examined is 5.

Table 8. Point table of the sections related to history of science in the 12th grade high school chemistry textbook

Dimension	Criterion	CLASS 12 CHEMISTRY BOOK				A.O.	Arithmetic Average of Dimensions
		Unit 1			2.Unit		
		1.Text	4.Text	7.Text	1.Text		
Conceptual	Contents	2	1	2	2	1.8	0.9
	Model	0	0	0	1	0.3	
	Theory-Law	0	0	0	0	0.0	
	Variability	1	1	1	3	1.5	
Procedural	Thinking	1	2	2	2	1.8	1.8
	Asking question	1	1	1	2	1.3	
	Research	2	2	3	2	2,3	
Contextual	Connection	2	0	3	3	2.0	1.3
	social-political	3	1	4	0	2.0	
	Well-being-development	3	3	3	0	2,3	
	scientific society	0	0	0	0	0.0	
	humanization	0	0	0	0	0.0	
	Common culture	1	1	2	2	1.5	
Total Points		16	12	21	17		
Arithmetic mean		1,2	0.9	1.6	1.3		

As seen in Table 8, when four reading passages containing elements related to the history of science in the 12th-grade high school chemistry textbook are evaluated together, the examination scale is evaluated in terms of conceptual understanding (mean 0.9) and procedural understanding (mean 1.8). It is at a low level in terms of contextual understanding (average 1.3). All of the reading passages in the book received partial marks from the review criteria. Only the third text received 4 points from the "social-political" criterion within the contextual understanding dimension. The highest score obtained from other criteria is 3. The mean scores of each reading passage obtained from the criteria are 1.2, 0.9, 1.6, and 1.3, respectively.

3.6. General Point Averages of the Sections Related to History of Science in High School Chemistry Textbooks

Table 10 below shows the total score and average score in 9th, 10th, 11th, and 12th-grade high school chemistry textbooks for each book review criteria in the scoring key.

Table 10. The general average of scores of the sections related to the history of science in high school chemistry textbooks

Dimension	History of Science Instructional Scale	9th grade	10th grade	11th grade	12th grade	Overall Average	Arithmetic Average of Dimensions
Conceptual	Contents	4	5	2.6	1.8	3,4	2.37
	Model	3	2	0.7	0.3	1.5	
	Theory-Law	3	3,5	0.3	0	1.7	
	Variability	5	3,5	1.6	1.5	2.9	
Procedural	Thinking	5	2.5	1.9	1.8	2.8	2.73
	Asking question	5	2	1.4	1.3	2,4	
	Research	5	2.5	2	2,3	3.0	
Contextual	Connection	5	3	2	2	3.0	1.63
	social-political	4	3,5	0.6	2	2.5	
	welfare-development	3	3,5	1.1	2,3	2.5	
	scientific society	1	2	0.4	0	0.9	
	humanization	1	0	0	0	0.3	
	Common culture	0	1	0	1.5	0.6	
Grade-Level Averages		3.38	2.62	1.12	1.29	2.11	

When Table 10 above is examined, it is seen that the highest average of 3.4 out of 5 belongs to the criterion that the history of science helps students learn scientific content and ideas. This average value is above the medium level. This criterion, coded as "content," is followed by "research" and "connection" criteria with an average value of 3. These two criteria have a medium level of value. It is observed that the mean values in other criteria continue to decrease from 2.9 to 0.3. In summary, this situation can indicate that even the reading passages directly associated with science use the history of science at the most moderate level. It was calculated as 2.37 in terms of conceptual understanding, 2.73 in terms of procedural understanding, and 1.63 in terms of contextual understanding . This shows that the use of the history of science is at the most moderate level.

Considering the number of texts in which elements related to the history of science are used on a class basis, there is 1 reading passage in the 9th-grade book, 2 in the 10th-grade book, 7 in the 11th-grade book, and 4 in the 12th-grade book. When the classes' averages are examined, it can be seen that the two highest averages are in the 9th and 10th-grade books (3.38 and 2.62, respectively). These averages are close to the average value of 2.5.

4. CONCLUSION, DISCUSSION AND SUGGESTIONS

History of science is a research activity that examines the development process of scientific knowledge (Topdemir & Unat, 2014). The purpose of the history of science is to examine the emergence, dissemination, and usage conditions of objective knowledge and techniques and, in a sense, to ensure the formation of a particular method, a type of thinking, and even a broad perspective (Yörükoğulları, 2013). According to Yıldız (2013), sections on the history of science in textbooks: What scientific knowledge means, how, when, and by whom it was created, how it developed and has survived to the present day, the individual characteristics of scientists, what they experienced during the scientific research process, what they were inspired by, their relationships with other scientists and their environments, the stages of the scientific process, the spirit of scientific research. It should support the development of students' understanding of both the content and the nature of science by reflecting on the characteristics of the time the research was conducted. In short, the history of science should be considered as a whole in terms of conceptual, contextual, and procedural aspects in textbooks. In this context, this research examined and evaluated high school chemistry textbooks from these perspectives.

According to the first result obtained from the research findings, the averages of the four books are at the most moderate level in terms of the analysis dimensions of the texts that can be associated with the history of science in the examined books. It can be said that this situation is equivalent to the studies that reveal the conclusion that the books used in chemistry courses in our country and around the world deal with different concepts and subjects in terms of the history and philosophy of science (Coştu & Niaz, 2012; Justi & Gilbert, 1999; Kılıç, 2010; Leite, 1996; Niaz, 2002; Yıldız, 2013). According to this situation, the average score of all the texts in the books decreases compared to the averages of the texts containing only the history of science elements.

When the books at each grade level are examined separately, results similar to this general result emerge. Firstly, when the 9th grade chemistry textbook was examined, a reading piece was determined in this book, and the science history average value of this reading piece was determined as 3.38. is similar to. In both studies, 9th grade books need to be more comprehensive regarding the elements examined. In terms of conceptual understanding, this text helps students understand scientific content and ideas, especially the variable nature of scientific knowledge.

Similarly, in terms of procedural understanding, it has been shown to the students that new information can be reached by questioning a scientific development, elaborating on it, or conducting different research. When this reading piece is examined in terms of contextual understanding, firstly, since it is clearly stated that scientific studies are related, 5 total points were given from this sub-

category. However, only 1 point was given because the relationship between scientific efforts and social and political factors, their impact on human welfare, the individuality of scientists, and cultural heritage were not included enough.

As a result of the examination of the 10th-grade chemistry textbook, the 2 texts in the book are close to the average level of 2.5 in terms of conceptual understanding, procedural understanding, and contextual understanding in terms of use of history of science (means 2.3 and 2.9). When the two reading passages in the book, which contain elements related to the history of science, are evaluated together, it can be said that both reading passages are at a good level of conceptual understanding.

Although seven of the 11th-grade high school chemistry textbooks contain various elements in terms of conceptual, procedural, and contextual understanding in terms of the use of history of science, they remained low (means 2.1 and below). When the seven reading passages in the book containing elements related to the history of science are evaluated together, it is sufficient to present scientific content in the conceptual understanding category.

At the same time, there are intermediate-level elements about the variability of scientific knowledge in the same category. In terms of procedural understanding, the reading passages contain sufficient elements to develop students' questioning, thinking, and research habits. On the other hand, in terms of contextual understanding, the reading passages are insufficient.

When four reading passages containing elements related to the history of science in the 12th-grade high school chemistry textbook are evaluated together, it is likely insufficient to present scientific content in the conceptual understanding category. At the same time, it can be said that there are intermediate-level elements about the variability of scientific knowledge in the same category. In terms of procedural understanding, it can be said that the reading passages contain sufficient elements to develop students' questioning, thinking, and research habits. Especially in terms of contextual understanding, it can be stated that reading passages are at a higher level than other understandings.

4.1. Suggestions

According to the research findings and results, high school chemistry textbooks are at a low level in terms of history of science. It has been emphasized in research that science education strengthened with the history of science increases the awareness of students, teachers, or candidates about the nature of science (Ayvacı, 2007; Can, 2008; Beşli, 2009; Kaya, 2007; Kıral, 2010). However, it can be thought that courses that are limited in terms of the history of science may cause students to have difficulty understanding the nature of science. Therefore, individuals with low levels of scientific literacy will be raised.

The following suggestions can be made to prevent these and similar problems:

1. The number of reading passages on the history of science can be increased at each grade level.
2. In addition to the existing reading passages, examples from the history of science related to the subject can be given.
3. Courses on the history of science or the nature of science may take place in high schools and equivalent institutions.
4. It may be more appropriate to present the history of chemistry as a separate chapter in the textbooks, in sections within each subject.

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