Journal of Theoretical Educational Science, 16(3), 536-573, July 2023
Kuramsal Eğitimbilim Dergisi, 16(3), 536-573, Temmuz 2023
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1268430

Deep Relationship Between the "Haha!" of Humor and the "A-ha!" of Learning: Context-Based Comic Book Development, Teacher and Student Opinions*

Mizahın "Haha"sı ile Öğrenmenin "Aha"sı Arasındaki Derin İlişki: Bağlam Temelli Çizgi Roman Geliştirilmesi, Öğretmen ve Öğrenci Görüşleri

Mustafa Kemal YÜZBAŞIOĞLU** **Mehmet Altan KURNAZ*****

Received: 21 March 2023 **Research Article** **Accepted:** 13 May 2023

ABSTRACT: The research aimed to determine the opinions of the students and the course teacher with regard to using the comic book prepared in accordance with a context-based scenario as teaching material for the science course. Phenomenology, one of the qualitative research approaches, was used for research purposes. A context-based comic book was used as course material for 12 hours in a class of 18 5th-grade students. Semi-structured interviews were conducted with seven students and a course teacher, following the implementation, using the interview forms developed within the scope of the current research. The data obtained from the interviews were analyzed by content analysis and classified under the themes of "Academic", "Affective", "Association with Daily Life" and "Comic Books and Humor". Pursuant to the results of the research, students, and course teacher declared the comic book as effective course material on the grounds that it makes the subject matter entertaining and understandable, facilitates learning, provides an opportunity for a permanent learning experience, provides an opportunity for individual learning, increases class participation, and supports the learning processes of students with literacy and language problems. Based on the results obtained, it has been suggested to use context-based comics in different units and lessons.

Keywords: Context-based learning, comic books, humor, science education.

ÖZ: Araştırmada fen bilimleri dersine yönelik bağlam temelli bir senaryoya göre hazırlanan çizgi romanın öğretim sürecinde kullanılmasıyla ilgili olarak öğrencilerin ve ders öğretmeninin görüşlerinin belirlenmesi amaçlanmıştır. Çalışmada, nitel araştırma yaklaşımlarından olgubilim deseni kullanılmıştır. Araştırmada bağlam temelli hazırlanan çizgi roman, 5. sınıfta öğrenim gören 18 öğrencinin bulunduğu sınıfta ders materyali olarak 12 ders saati kullanılmıştır. Uygulama sonrasında yedi öğrenci ve uygulama öğretmeni ile mevcut araştırma kapsamında geliştirilen görüşme formları aracılığıyla yarı yapılandırılmış görüşmeler gerçekleştirilmiştir. Görüşmelerden elde edilen veriler içerik analizi ile çözümlenerek "Akademik", "Duyuşsal", "Günlük Yaşamla İlişkilendirme" ve "Çizgi Roman ve Mizah" temalarında sınıflandırılmıştır. Araştırma sonucunda öğrencilerin ve uygulama öğretmenin çizgi romanın ele alınan konuyu eğlenceli ve anlaşılır kılması, öğrenmeleri kolaylaştırması, kalıcı öğrenmelere fırsat tanıması, bireysel öğrenmelere olanak sunması, derse katılımı artırması, okuma yazma ve dil bilme konusunda problemleri olan öğrencilerin öğrenmelerini desteklemesi gibi durumlardan dolayı etkili bir öğretim materyali olduğu yönünde görüş bildirmişlerdir. Elde edilen sonuçlardan hareketle bağlam temelli olarak tasarlanan çizgi romanın öğrencilerin öğrenmelerini desteklemesinden dolayı öğretim materyali olarak farklı ünite ve derslerde yaygınlaştırılması tavsiye edilmiştir.

Anahtar kelimeler: Bağlam temelli öğrenme, çizgi roman, mizah, fen eğitimi.

* This study was derived from the primary author's doctoral thesis.

**Corresponding Author*: Dr., Ministry of National Education, Kastamonu, Türkiye, m.kemalyuzbasioglu@gmail.com, http://orcid.org/0000-0001-8551-2440
*** Prof. Dr., Kastamonu University, Kastamonu, Türkiye, altan.kurnaz@gmail.com, http://orcid.org/0000-0003-2824-4077

Citation Information
Yüzbaşıoğlu, M. K., & Kurnaz, M. A. (2023). Deep relationship between the "Haha!" of humor and the "A-ha!" of learning: Context-based comic book development, teacher and student opinions. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 16*(3), 536-573.

ISSN: 1308-1659

Contemporary teaching approaches draw attention to the significance of allowing students to take an active role in the process of knowledge construction. The idea that students will construct knowledge by directly accessing information constitutes the basis of this view. Every day a new scientific development is introduced, making it necessary for the teaching environments to keep up with the age and to search for innovations that will draw the interest of the students to the course. In this context, teachers are expected to design teaching environments that will enable students to construct knowledge in a meaningful and permanent way. However, in some cases, students may have difficulties adapting to these teaching environments and constructing the relevant subject in their minds. These circumstances lead the students to ask, "Why do I need to learn this information?" (Gilbert, 2006). An effective teaching environment should help students make connections between scientific concepts and daily life (Karslı & Yiğit, 2017; Rose, 2012; Ültay, 2012). Associating the information that students acquire at school with daily life allows the knowledge to be made more meaningful in the students' minds. (Taşkın & Moğol, 2017). However, it has been reported that students may encounter problems in associating science subjects with daily life (Gitari, 2016; Lay et al., 2013). Furthermore, students who fail to make sense of daily life problems and to construct the necessary connections with scientific knowledge cannot offer solutions to those problems (Akbulut & Çepni, 2013). The curriculum aims to equip students with the knowledge and skills necessary to solve daily life problems they may encounter (MoNE, 2018). Hence students' inability to associate scientific knowledge with daily life problems will hinder the achievement of the objectives of the curriculum. To prevent or eliminate such possible deficiencies, it is necessary to create learning environments that will enable the establishment of a relationship between the knowledge learned at school and daily life.

Context-Based Learning (CBL), which has been widely applied in recent years and also accepted in Turkey, is an approach that emerged with the aim of enabling students to establish the connection between acquired scientific knowledge and daily life (Gilbert, 2006; Sözbilir et al., 2007). The CBL approach transfers selected contexts from students' daily lives to the teaching environment (Bennett et al., 2007; Gilbert, 2006; Ültay, 2015). Thus, it is aimed to ensure the association of scientific knowledge with daily life (Fensham, 2009; Ültay, 2012) and to increase students' interests, attitudes, and motivation for the lesson (Sözbilir et al., 2007). The CBL approach further allows students to have the opportunity to see the equivalents of the knowledge they have acquired in their daily lives. Thus, students' attitudes toward the lesson develop positively, and students are motivated towards the lesson (Bennett, 2016; Ültay & Ültay, 2012). Thus, it can be said that the use of qualified teaching materials suitable for the CBL approach in the lessons will contribute positively to the learning process. Course materials within the context of CBL are prepared by teachers and presented to students (Vos et al., 2011). Countries such as Germany, England, and the Netherlands offer teachers pre-prepared contents/course materials to be used in lessons within the scope of CBL and teachers are asked to adapt these contents to their own learning environments (Pilot & Bulte, 2006; Schwartz, 2006). However, there are no/insufficient ready-made course materials appropriate for the program, as the science curriculum (MoNE, 2018) was not prepared directly in accordance with the CBL approach. If we consider the wide scope of the subject area of science, there are a limited number of

studies that include course contents, activities, and course materials for science courses prepared in accordance with CBL (e.g., Akın Yanmaz, 2021; Çelik, 2021; Hoşgören, 2018; Kara, 2016; Sari, 2010; Tulum, 2019; Ültay & Ültay, 2012). Thus, ensuring high-quality learning environments with the CBL approach also requires the need for new research from different perspectives, such as teaching by using comic books.

Today, the course materials most widely used in teaching environments are textbooks (Kılıç & Seven, 2007). Science and technology have been advancing very rapidly in the age that we live in, bringing the question of whether textbooks alone are sufficient for teaching environments. Teachers may require different materials to achieve the objectives of a curriculum. For this reason, teachers make use of various activities, contents, experiments, and course materials that will attract students' attention to the lesson and improve their motivation. It is possible to say that comic books are also partly used for this purpose. Although not widely used in science education, the popularity of comic books has been increasing every day, and comic books find a place as course material that attracts attention (Yüzbaşıoğlu & Kurnaz, 2022a). The reason for the popularity of comic books is that they directly convey the facts and experiences of the period in which they were designed (Haugen, 2005). Many factors, such as the use of images, the gestures and mimics of the characters in the script, and the setting of the plot, attract the attention of the reader (Çiçek Şentürk, 2020; Yüzbaşıoğlu & Kurnaz, 2022a). Contrary to popular belief, comics are read with interest not only by younger individuals but also by adults. It was reported that the knowledge and attitudes of individuals aged between 20-65 on the subject discussed in the comic books and their interest in learning have improved significantly (Lin et al., 2015).

Comic books are used as course materials because of their effects on the reader. One of the significant reasons regarding the use of comic books as educational material is that they present the information to the students with the integrity provided by the harmony of text and images. Textbooks alone may be insufficient in attracting and maintaining students' interest in the course as most of their content is written. However, comics have the potential to reduce the amount of text presented to the students (Affeldt et al., 2018; Ünal & Demirkaya, 2019). The students of today desire to be able to go beyond the activities performed in the classroom (James B. Hunt, Jr. Institute for Educational Leadership and Policy, 2007). This desire can be achieved with the features of comic books; thus, comic books have been considered an effective tool in attracting students' attention (Tatalovic, 2009; Yıldırım, 2016).

The use of comic books in science education, by its very nature, offers students extraordinary learning opportunities (Tatalovic, 2009) and provides the opportunity to associate daily life situations with scientific knowledge by transferring them to learning environments (Affeldt et al., 2018). In this way, students are provided the opportunities to think and discuss science subjects and concepts (Olson, 2008). Owing to the use of comic books in the classroom environment, students may experience reflections on the science-related subjects and concepts they learned at school in their daily lives. Thanks to all these features and the potential they have, the use of comic books for the CBL approach serve as a tool that will bring daily life situations to the teaching environment in an entertaining and interesting way for students. The context-based comic books presenting the reflections of scientific knowledge in daily life with a well-structured

script and plot where students can find something about themselves are thought to serve as effective teaching materials. Based on these points, the present study is aimed to reveal the opinions of students and teachers after the use of a comic, which was designed by the researchers with a context-based scenario for the science lesson in the teaching environment. To this end, answers to the following questions were sought in this research.

− What are the views of the participating students regarding context-based comics?

− What are the views of the teacher who conducts the applications with context-based comics?

Method

Phenomenology, one of the qualitative research approaches, was used for research purposes. Phenomenology studies focus on lived experiences (Merriam & Tisdell, 2015) by investigating responses and perceptions about a particular phenomenon (Fraenkel et al., 2012). It requires explaining how people perceive and define a certain phenomenon, along with revealing how they make judgments and describe it to people (Patton, 2015). For this reason, researchers conduct in-depth interviews with individuals who have direct experience to uncover the underlying structure of an experience, allowing participants to reflect on their experiences (Fraenkel et al., 2012). Thus, semi-structured interviews were conducted with the students, and the course teacher regarding the teaching practices with context-based comic books for the purpose of the present study, and their thoughts were examined.

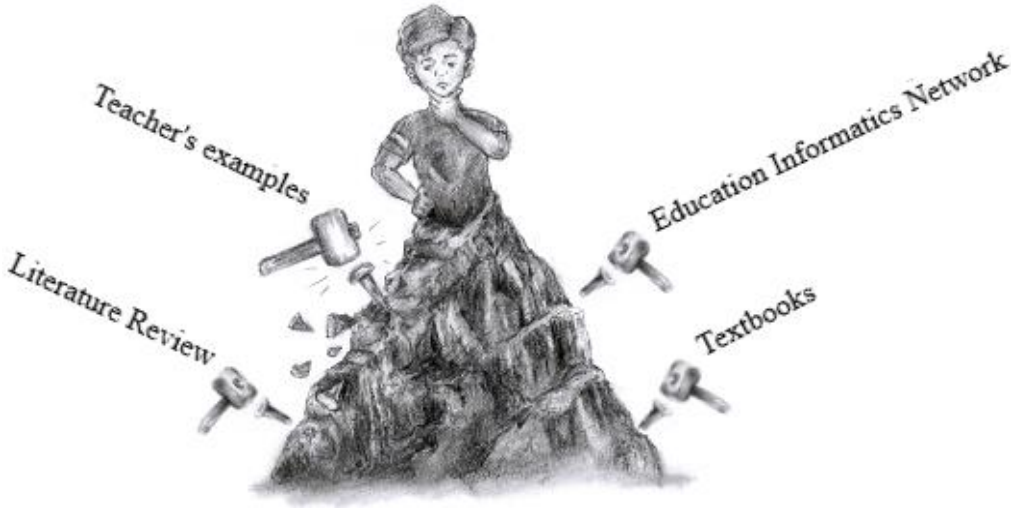
Context-Based Comic Book Development

For the research, a comic book was developed which presents a scenario consisting of contexts for measuring the force and frictional force. While developing the comic book, first, the scenario was fictionalized by considering certain situations (Figure 1).

First, the relevant literature was reviewed to develop the instructional scenario. To accomplish this, teaching practices that would contribute to the comprehension of topics such as force measurement and frictional force were explore (Doğan, 2020; Gülen & Bozdoğan, 2021; Güven et al., 2018; Hacıoğlu, 2020; Kırıcı et al., 2018; Külekci, 2019; Solvang & Haglund, 2021; Taşkın & Moğol, 2017) and the subjects that the students have difficulty in learning with their alternative ideas in this regard were determined (Canlas, 2021; Ishimoto, 2010; Kurnaz & Ekşi, 2015; Tavukçuoğlu, 2018; Yüzbaşıoğlu & Kurnaz, 2022b). Subsequently, instructional content aimed at addressing common alternative conceptions in the subject area and promoting academic success was developed.

Figure 1

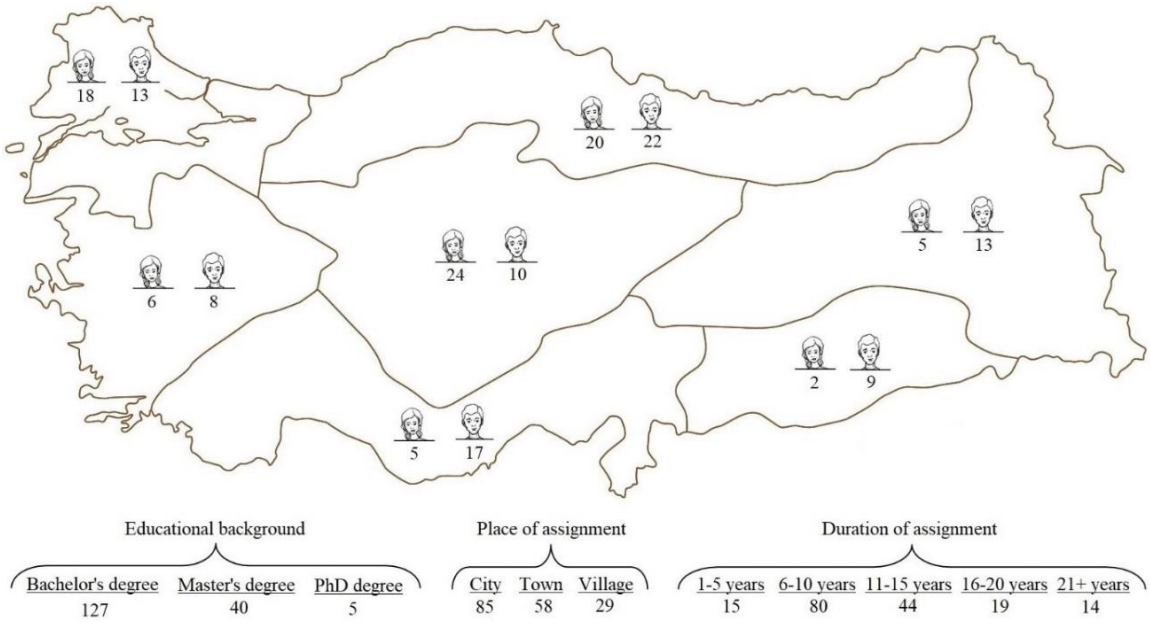
Scenario Development Stages of the Context-based Comic Book



Next, the contents and activities offered in the Education Informatics Network (Eğitim Bilişim Ağı, EBA) were examined in depth. Education Informatics Network (EBA) is a Turkish social education platform that caters to preschool to secondary education levels. It provides various learning materials, including videos, documents, e-books, tests, and activities. In addition, the contents of the textbooks used at schools were examined. These steps helped to compile the academic information required for the narrative that will be included in the scenario of the comic book.

Figure 2

Demographic Information of Participating Science Teachers



Following the preparatory step, the subsequent phase involved placing the narratives in the scenario and developing the appropriate contexts. Attention was paid to ensure that the contexts to be developed were understandable and diverse for students. In relation to this, science teachers assigned in different geographical regions of Turkey

were asked to associate five learning outcomes in the curriculum with daily life and provide examples for these associations. For this purpose, an online form was created that prompts participants to associate the learning outcomes with daily life. This form was shared with the teachers on the Internet and completed by 172 volunteer science teachers (Figure 2).

The teachers' responses were reviewed, and examples appropriate to be used for the comic book scenario were determined. The answers, which include context examples provided by the teachers regarding the learning outcomes of the science course curriculum, are presented in Table 1.

Table 1

Examples of Learning Outcome-Context Association Presented by Science Teachers

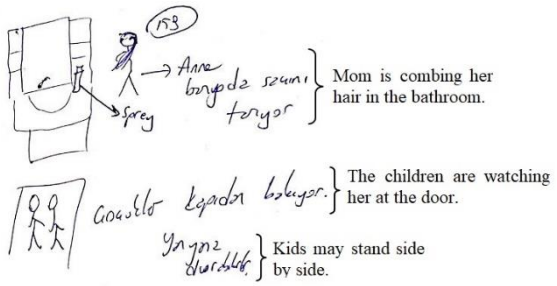
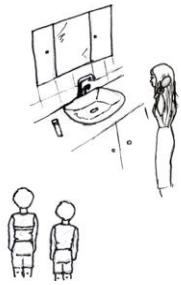
Learning outcomes	Gives examples of friction force from daily life.
Contextual Example provided by a Participating Teacher	Using hair conditioner while washing our hair and combing our hair easily without damaging is an example of reducing the friction force.

A comic book scenario was developed by making use of the context-learning outcome associations presented in Table 1 and the procedure indicated in Figure 1. Within the scope of scenario development, a plot directly related to daily life was constructed. Thereafter the main and supporting characters were designated in accordance with the storyline. Care was given to constructing characters that the reader could empathize with while determining the characters. An exemplary section on the development of the comic book scenario and the preparation of illustrations is presented in Table 2.

The Scenario, a section of which is presented in Table 2(a), along with draft illustrations, was prepared in line with the contexts developed for measuring the force and frictional force learning outcomes. Characters and events were illustrated by an expert illustrator, in line with the draft illustrations and information provided in Table 2(b). The illustration step required paying attention to make drawings suitable for the nature and elements of the comic book (e.g., Table 2(c)). The conversations between the characters were finalized after the illustrations were completed. Speech bubbles were placed in appropriate places on the illustrations, and necessary arrangements were made to separate the illustrations from each other (e.g., Table 2(d)). After all illustrations suitable for the scenario were completed, the speech bubbles of the characters were reviewed to be read from left to right and from top to bottom in accordance with the nature of the comic book.

Table 2

Exemplary Section on the Comic Book Development

Comic Book Development Steps		Example
Developing the Scenario	(a)	*The children call out to their mothers, telling them that they are ready to go out. Mom answers that she is combing her hair and is almost ready. The children step right up to their mom and ask what she puts on her hair. Mom says it's hair conditioner. Little boy asks his mother why she is applying the hair conditioner. The mother explains why.*
Preparing the draft illustrations on the scenario.	(b)	
Preparing the illustrations	(c)	
Placing speech bubbles.	(d)	

The developed context-based comic book was submitted to expert opinions to examine whether it can be used as course material in terms of language, intelligibility, learning outcomes, and context suitability. A total of eight experts, including three science instructors, a physics teacher, a language expert, a curriculum development expert, and two science teachers, were consulted for the approval of the comic book. Illustrations of some sections of the context-based comic book were detailed in line with expert opinions. Furthermore, illustrations aiming to introduce the characters were added to the introduction section. A pilot scheme was implemented in a classroom of 14 students before the comic book was finalized. Two students (one boy and one girl) in the fifth grade were asked to read the comic book and present their opinions following the necessary edits. Accordingly, the 80-page Context-Based Comic Book (CBC), exemplary sections of which are presented in Figure 3, was finalized.

Figure 3

Exemplary Sections of the Context-Based Comic Book

Teaching Implementation

The lessons were taught by each lesson's own teacher using CBC Book. The teaching process lasted 3 weeks and 12 course hours in total, and the details are presented in Table 3.

Table 3

Teaching Process

Week	Duration	Learning Outcome
1. Week	4 course hours	The magnitude of the force is measured with a dynamometer.
2. Week	2 course hours	Designs a dynamometer model using simple tools.
2. Week	2 course hours	Gives examples of friction force from daily life.
3. Week	2 course hours	Explores the effect of friction force on motion by experimenting in different environments.
3. Week	2 course hours	Proposes new ideas to increase or decrease friction in daily life.

Implementation Group

CBC Book was used as course material within the scope of a science course in a class with 18 students. The implementations were conducted by the respective teachers of each lesson. Interviews were held with teachers and students after the teaching implementations were completed. Criterion sampling method was used to determine the students to be interviewed. Criterion sampling is a method used to determine an implementation group that has sufficient knowledge and experience within the framework of the research subject and can provide a rich seam of information (Patton, 2015). For the purpose of the current research, the context-based learning status test developed by Yüzbaşıoğlu (2022) was administered to the students before and after teaching the relevant subject. The criteria were determined based on the answers provided by the students to the test, and the students were selected accordingly (Table 4).

Table 4

Criteria Taken into Account While Choosing the Students

Criterion	Gender		Total Number of Students
	Girl	Boy	
Highest score	1	1	2
Lowest score	1	1	2
Highest increase	1	1	2
Reading difficulties	1	-	1

The willingness of the students to be interviewed was also taken into consideration. S1 and S17, who provided the highest number of correct answers to the questions in the learning status test, were included in the interviews within the framework of the Highest Score Criterion. S3 and S6 were included within the framework of the Lowest Score Criterion, whereas S9 and S18 were included within the framework of the Highest Increase between the pre-test and post-test scores. On the other hand, S15 was included in the interviews due to their specific situation of experiencing difficulties in reading.

Data Collection Tools and Data Collection Procedure

The perspectives of the students and the teacher on the use of the CBC Book within the framework of teaching implementations were determined through semi-structured interviews. Comic Book Student Interview Form and Comic Book Teacher Interview Form were used for this purpose. The relevant literature was reviewed, and open-ended questions were used while developing the forms. Expert opinion was taken from two science instructors for the Interview Form developed. Some questions were revised in line with expert opinions, and the Comic Book Interview Forms were finalized accordingly. Two exemplary questions taken from the interview forms are presented in Table 5.

Table 5

Exemplary Questions from the Comic Book Interview Forms

Comic Book Student Interview Form Exemplary Question
What do you think about the use of comic books in science class?
Comic Book Teacher Interview Form Exemplary Question
What kind of reactions did you get from the students in general when you were teaching with comic books?

Comic Book Student Interview Form (see Appendix 1) and Comic Book Teacher Interview Form (see Appendix 2) constituted 10 and 6 questions, respectively. Semi-structured interviews were held with voluntary students and the course teacher following the teaching implementations using CBC Book. Interviews with the students were held in the science laboratory, in an environment where they could express themselves comfortably, and lasted an average of 10 minutes. Course teachers were interviewed in the same environment after the interviews were held with the students. The interviews conducted with the teachers lasted approximately 25 minutes. Interviews with students and teachers were.

Data Analysis

The data obtained from the answers provided by seven students and one teacher who participated in the interviews were analyzed using content analysis. Content analysis usually involves analyzing textual data, such as a breakdown of data derived from interviews. Transcribed interview recordings constitute a complex dataset, and simplifying this complexity and extracting meaningful insights from them is the challenge in content analysis. Content analysis technique includes identifying, coding, categorizing, classifying, and labeling primary patterns in data (Patton, 2015). For the current research, not all participants were asked the same questions in a uniform order throughout the semi-structured interviews. Each participant was asked further different questions in line with the answers received to reveal the participants' in-depth views on the CBC Books. The researchers took an active part in the whole process of developing codes, themes, and sub-themes after the data were transcribed. According to Patton (2015), inter-rater reliability (IRR) is appropriate for semi-structured interviews in which all participants are asked the same questions in the same order, and the data is coded at once. No inter-rater reliability check was conducted due to several reasons, including the independent coder's limited depth of knowledge compared to the researcher, the challenge of reading all the interviews, and the potential loss of richness in coding sub-themes and themes when coding superficially. The recordings of the 79-minute interviews held with the students and 24 minutes interview with the practicing teacher were transcribed. Then, the meaningful and remarkable parts of the text prepared for student interviews were coded. In the next step, a total of 49 codes were listed, and these codes were grouped under a common theme. Thus, four themes and 26 sub-themes were determined based on the codes. The themes created were reviewed again, and the themes were combined when necessary. Then the themes were refined and finalized as four themes and 21 sub-themes. The same steps were further carried out for the interview held with the implementing course teacher; accordingly, four themes and 14 sub-themes were created based on the 32 codes reached in total. At the end of

the aforementioned steps, students' opinions about CBC Book were classified under the themes of academic, affective, daily life association, comics, and humor. The opinions of the implementing course teacher were also grouped under the same theme headings. Creswell (2014) outlined various strategies developed to ensure validity in qualitative research. For the current research, the themes were derived from integrating the perspectives of the participants. Within the context of qualitative research, a detailed explanation was provided with direct quotations, detailed definitions, and multiple perspectives on each theme aiming to make the results more realistic and richer.

Ethical Procedures

This study received ethics approval from the Kastamonu University Social and Human Sciences Research and Publication Ethics Board (Dated 12.10.2020 and numbered 2020/3/40).

Results

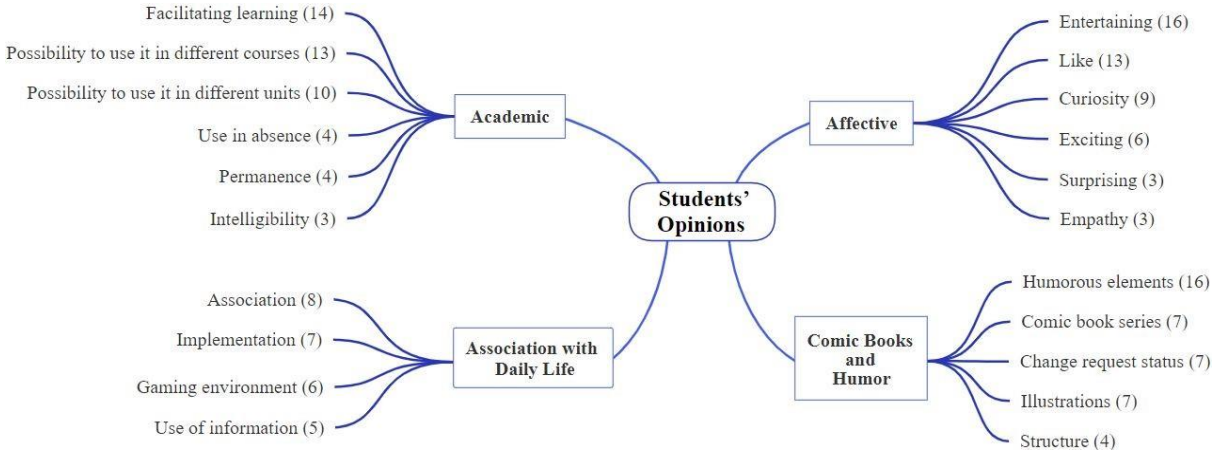
The findings obtained from the interviews conducted with the students and the course teacher, following the implementation of CBC Book in teaching, are presented under two separate headings.

Students' Views on Context-Based Comic Books

As a result of the analysis of the data obtained from the students, the opinions about the CBC Books and the implementation process were examined under the themes of "Academic," "Affective," "Association with Daily Life," and "Comic Books and Humor." The themes and sub-themes developed in line with the students' views on CBC Book and its implementation are presented in Figure 4.

Figure 4

Students' Views on CBC Book and Its Implementation



Theme "Academic"

The theme "academic" consists of sub-themes of Facilitating Learning, Possibility to use it in different courses, Possibility to use it in different units, Use in absence, Permanence, and intelligibility. The sub-theme of Facilitating Learning includes the codes of Sampling (f=6), Teaching the Subject (f=4) and Using Illustrations (f=4). Students stated that using comic books in the science lesson facilitated learning,

and thus they learned the related subject more easily. The students indicated the reason underlying this situation as that the information/knowledge presented in the comic book was chosen from the events they have constantly seen or encountered in their environment, detailed by associating with daily life and supported by illustrations. An exemplary student response regarding how the comic book facilitates learning is presented below.

> "The comic not only shows the information but also explains why it is so. In some books, for example, they have an adventurous car race; one wins, and the other loses. The character asks why he couldn't win. However, there is no mention of why he won or lost the race. But it is mentioned here, the reason why Ilgaz won is explained here, which I think is very good." (S18, Girl) (The name of the character in CBC Book is Ilgaz.)

The students were asked further questions about which other courses CBC Book could be used, why they mentioned those courses, the differences between the current textbook used for the preferred course and the comic book, and which features of the comic book they want to bring to the lessons in question. Social sciences (f=7), Turkish (f=4), and Mathematics (f=2) codes were derived in line with these questions, and these codes were then grouped under the "Possibility to use it in different courses" sub-theme. While all the students said that comic books could be used in social sciences courses, the majority of them stated that comic books could be used in Turkish and Mathematics lessons in addition to social sciences. The reason underlying this situation was indicated as the prevalence of text-based materials in the courses in question, that it would be more enjoyable, and they would comprehend more easily if these topics were taught with comics. The code "Social sciences" was found to be the most frequently recurring code under the sub-theme of "Possibility to use it in different courses.". An exemplary student response regarding the possibility of using the comic book in different courses is presented below.

> "… because it helps you to comprehend the Social sciences lesson better. We can learn about the historical events mentioned in the social sciences lesson. We can more easily understand the points that are difficult to understand in the social studies lesson." (S3, Girl)

The students were asked further questions about whether different units can be taught using comic books, which units they would like to be taught using comic books, and reasons for mentioning these units. All units (f=4), Living world (f=3), Matter, and Change of State (f=2), as well as Electrical Circuit Components (f=1) codes, were reached in line with these questions. These codes were then grouped under the "Possibility to use it in different units" sub-theme. While some of the students wanted comic books to be used in Living world, Matter and Change of State along with Electrical Circuit Components units, the majority of them stated that they wanted comic books to be used in all units. Students further stated that they had difficulty comprehending the subject when other textbooks or supplementary materials were used; however, they both understood the subject without any difficulty and also had fun when CBC Book was used. All units were found to be the most repeating code under the "Possibility to use it in different units" sub-theme. An exemplary student response regarding the possibility of using the comic book in different units is presented below.

> "Let comic books be used in any topic, any topic, any subject. This is so good!" (S15, Girl)

The students were then asked further questions about whether or not they were absent in the courses lectured using CBC Book, how they made up for missed classes, how they made up for non-science courses that they could not attend, and the

differences between reading the comic books and the books of other courses while making up the courses which they could not attend. The codes Health status (f=2) and Personal studying (f=2) were identified in relation to these questions and subsequently grouped under the sub-theme of "Use in absence." The students stated that they tried to make up for their deficiencies by reading the comic books for the science course and the books of the related course for the other courses on the days that they were absent. Students said that they effectively made up for the science lessons lectured on the days they were absent thanks to the comic books; however, there were subjects that remained miscomprehended in other courses. A student response regarding the "Use of the comic book in absence" is presented below.

> "I got sick. For this reason, there were days when I was absent from the class. I got very upset. I wondered which page we were on and what happened. I found out which page we were on by asking my friends. For example, I asked which topics were lectured in the social sciences lesson, I learned the pages. I pretended these pages to be given homework and read these pages from the book at home. I also read the comics. Ilgaz and Berk were talking among themselves. As they talked and as I read, they made me happy. When I read the comic book, I understood the subject better." (S15, Girl) (The name of the other character in the CBC Book is Berk.)

Permanence (f=3) and staying in mind as the student likes it (f=1) codes were grouped under the "Permanence" sub-theme. Among the students interviewed, there were some who stated that they had read the comic book before. However, they did not forget the subject of the comic book, and it permanently remained in their minds despite the reasonable time that passed over. When students were asked whether they remembered other books that they had read throughout the same period, they stated that they clearly remembered the comic book and the subject it dealt with, while they could not exactly remember other books. A student response regarding the fact that "The content of the comic book has a more permanent place in the minds of the students compared to other books" is presented below.

> "I used to read comics while in second grade when I was very young. It was about history. It was about the Çanakkale Victory. The subject was our martyrs there. Some cities were renamed as (Glorious) Urfa and (Ghazi) Antep. I also read those books. I had read comic books about these topics but never read one about the course like this… I don't remember exactly the other books I read back then, but I remember the comics because I loved them. I hardly forget the things I love. They are on my mind. "(S17, Boy)

Detailed Explanation (f=2) and Concretization of the subject (f=1) codes were grouped under the "Intelligibility" sub-theme. Under these codes, the students indicated their ability to understand the comic book and the subject in question. The students indicated that they may have difficulty in understanding the expressions referred to in the textbooks or different course materials when they read them, but this was not the case concerning the comic books and that they clearly understood the subject without any difficulty from the first reading. Supporting the expressions in the comic books with illustrations helped the subject to be visualized in students' minds and made it more understandable. Detailed Explanation was found to be the most repeating code under the "Intelligibility" sub-theme. A student response regarding these views is presented below.

> "When I read the textbooks, I had a hard time understanding, subjects are more explicitly explained in the comics. The comic books also explain things, moreover, they are illustrated. These illustrations were not in the textbooks. I read the textbooks 2-3 times, over and over, to

> understand, but this is not the case in comics. I understand comics immediately when I read them." (S3, Girl)

Theme "Affective"

Theme "Affective" consists of the sub-themes of Entertaining, Like, Curiosity, Exciting, Surprising, and Empathy. Amusing (f=12), Laughter (f=2), and Comic (f=2) codes were grouped under the "Entertaining" sub-theme. Students expressed that they found the dialogues between the characters and the events that took place in the story very entertaining, and that it was enjoyable to read the CBC Book, although they could not fully understand the correlation between the comic book and the course when they first saw it. When students were asked why a comic book seemed entertaining to them, they stated that the illustrations and speech bubbles made them feel like they were in the narrated place and that the humorous elements made the comic book entertaining. They further explained that this made them learn the subject better. Amusing was found to be the most repeating code under the "Entertaining" sub-theme. An exemplary student response regarding the fact that "The students found the comic book entertaining" is presented below.

> "... I was a little excited at the beginning that I was going to read the comic book. Then I found it entertaining when I read it; it was really nice. The fact that it's entertaining makes it even easier to learn." (S9, Boy)

Being happy (f=5), Enjoying (f=4), Finding beautiful (f=3), and Interesting (f=1) codes were grouped under the "Like" sub-theme. All of the students interviewed said that they liked the CBC Book. The students expressed that they liked the comic book on the basis of reasons such as its narrative style, content, script, being supported with illustrations, the topics concerned, humorous elements, and the comprehensibility of the information presented. An exemplary student response regarding the statement "The students liked the comic book" is presented below.

> "I hadn't read comic books before... I read this, and I liked it a lot. I couldn't sufficiently understand other books. There are more understandable things in this book, that's why I liked it." (S3, Girl)

Being curious about the content (f=6) and Wondering about the rest of the adventure (f=3) codes were grouped under the "Curiosity" sub-theme. The students said that they were curious to see the contents from the first moment they got hold of the comic book, that the adventures and illustrations attracted their attention when they started to read it, they were curious about what would happen on the next page. Also, that is why they wanted to finish the book as soon as possible. The students who participated in the research stated that they finished the comic book quickly because they were curious about the ending. Being curious about the content was found to be the most repeating code under the "Curiosity" sub-theme. An exemplary student response concerning the Theme "Curiosity" is presented below.

> "When our teacher gave me the comic book, I was curious about the content and the ending. I thought about what kind of adventures there are. We were going to learn about the measurement of force and friction, but I wondered what these issues had to do with the comic book; however, I realized the correlation when I read it later on." (S17, Boy)

Getting excited while reading (f=4) and Adventures (f=2) codes were grouped under the "Exciting" sub-theme. The answers concerning the students' excitement during the implementation of the CBC Book were presented based on these codes. Students expressed their excitement about the adventures in the script from their initial

encounter with the comic book and throughout its implementation and they also expressed a desire to quickly finish reading the comic book. Getting excited while reading was found to be the most repeating code under the "Exciting" sub-theme. An exemplary student response regarding the fact that "The students found the comic book Exciting" is presented below.

> "I was a little excited that I was going to read comic books for the first time. I felt different as if I had seen something new for the first time." (S6, Girl)

Failure to set the correlation (f=2) and Encountering the comic book for the first time (f=1) codes were grouped under the "Surprising" sub-theme. The students said that they were initially surprised when they first saw the comic book and did not understand its connection to the science course. However, their surprise diminished once they started reading it. An exemplary student response concerning "the students who were surprised when they saw the comic book" is presented below.

> "When I first saw it, I was surprised that we were going to read comic books for the first time; after reading it, I felt happy." (S1, Boy)

The sub-theme "Empathy" consisted of thinking similarly with the character (f=2) and daydreaming (f=1) codes. Students expressed that during the lesson taught using the comic book, they imagined themselves in the shoes of the characters and felt as if they were speaking the dialogues in the speech bubbles directly to someone in front of them. They further expressed that they internalized the subject while the lesson was taught, and thus, they were not bored. An exemplary student response concerning Sub-theme "Empathy" is presented below.

> "I had different dreams. I wanted to read the comic book. I read the comic book, and I put myself in the place of the characters while reading it. I felt like I was talking to them in front of them. That caused me to better understand the subject." (S15, Girl)

Theme "Association with Daily Life"

The sub-themes of this theme are Association, Implementation, Gaming environment, and the Use of information. Problems encountered (f=3), Friendship environment (f=3), and Family environment (f=2) codes were grouped under the "Association" sub-theme. Students said that they used the information they got from the comic book to explain the reason for an incident that happened during a conversation while chatting with their friends or family or while solving a problem they encountered in their close environment. An exemplary student response concerning the Theme "Association" is presented below.

> "When we were in the village, the tractor once got stuck in the mud when the soil softened in the field. There was a similar incident in the comic book where the truck broke down on the road. Then my uncles saved the tractor." (S6, Girl)

Testing the knowledge acquired (f=3), Material construction (f=2), and Measurement (f=2) codes were grouped under the "Implementation" sub-theme. Students said that the topics covered in the comic book during the lessons taught using CBC Book included situations that they have encountered or may encounter in their daily lives. They further stated that they converted the knowledge acquired from the comic book into practice by using the materials or tools they found in their close environment. In this particular context, the students created a dynamometer using the available materials and conducted measurements with the dynamometer. They did this during visits to the village, as well as by driving their toy cars or bicycles in various

environments, aiming to observe and compare the effects of friction force. In this way, they also had the opportunity to observe the different applications of the information they acquired at school. A student response concerning "The activities performed by the students within the scope of sub-theme Implementation" is presented below.

> "My brother and I performed a similar car race described in the comic book. I drove my car on the carpet, and my brother drove on the tile; my brother beat me. My car kept getting stuck on the carpet while my brother's car went faster on the tile." (S3, Girl)

The students were further asked whether they could associate the knowledge they acquired at school using the CBC Book with their daily lives. The codes Cycling (f=3), Playing basketball (f=2), and Driving a Toy Car (f=1) were generated in response to these questions, and they were subsequently grouped under the sub-theme of "Gaming environment". Students stated that they were able to associate an event that took place in their gaming environment and the knowledge they acquired in the science course using the CBC Book. They further indicated that they were able to use the information they acquired in the lesson to solve the problem situation similar to or different from the events encountered in the comic book scenario or explain the reason for it. An exemplary student response related to the "Gaming environment" sub-theme is provided below.

> "I learned about the friction force in class. I stepped on the brake while riding a bike, and the bike slowed down and stopped. I said that this situation is caused by the friction force." (S1, Boy)

Equivalent in daily life (f=4) and Concrete examples (f=1) codes were grouped under the "Use of information" sub-theme. The students reported that CBC Book, supported by dialogues and illustrations, provided them the opportunity to observe the equivalents of the acquired subjects and concepts in daily life. They further stated that they had the opportunity to learn the working principle of the dynamometer while the characters in the comic book were picking apples in the village garden, the use of thin and thick springs in the dynamometer when the characters disrupted the elasticity of the dynamometer spring in the schoolyard and to observe all of these topics with examples of everyday life. The illustrations in the CBC Book enabled the related topics to become more concrete in students' minds. A student response concerning the "Use of information" sub-theme is presented below.

> "For example, you are going to buy a dress, and you need to compare the money in your pocket with the money required for the dress in the math class. This situation can be described in a comic book. It might be a little different, but it would be entertaining." (S6, Girl)

Comic Books and Theme "Humor"

Humorous elements, Comic Book Series, Change request status, Illustrations, and Structure sub-themes are grouped under the theme "Humor" The characters' saying bandy words to each other (f=9) and the Funny episodes (f=7) codes were grouped under the "Humorous Elements" sub-theme. Students expressed that they found learning a particular subject much more enjoyable when the characters were engaging in playful banter with their siblings, competing in races, exchanging jokes with school friends, and in episodes where humor played a prominent role. The students described the comic books as both entertaining and informative based on the fact that the scenarios covered were supported by illustrations and included humorous elements. An

exemplary student response related to the "Humorous Elements" sub-theme is presented below.

> "I laughed aloud when two brothers were having a conversation and argument; this made me feel happy. Towards the end, they were going to the amusement park. They were having an argument while picking apples in the village, they were arguing at school, and it was very funny when they were pulling ropes with girls." (S15, Girl)

Awaiting upcoming episodes (f=5) and search for similar comic books (f=2) codes were grouped under the "Comic Book Series" sub-theme. The students stated that they liked the structure of the comic books, that they were entertained when they read it, and that they better understood the subject intended to be taught; so, they wanted to read more. They further indicated that they searched for similar comic books, and they found examples of comic books that were not related to the lessons, but they had difficulty finding comics that were directly related to their lessons. The students interviewed expressed that they would be happy to have new comic books which covered different course topics. Some of the students expressed a desire to have comic books featuring the same characters but with adventures related to different subjects taught in their courses. Awaiting upcoming episodes was found to be the most repeating code under the "Comic Book Series" sub-theme. An exemplary student response concerning these issues is presented below.

> "For example, Ilgaz and Berk may visit other places in the books prepared for other courses. They may visit China and meet other friends. It would be like a textbook set. We love the adventures of Ilgaz and Berk. They may have different adventures in mathematics, something else in social studies." (S18, Girl)

Finding sufficient (f=4) and Coloring request (f=3) codes were grouped under the "Change request status" sub-theme. The students were further asked which changes they would like to make to the comic books. Some of the students interviewed stated that the comic books could be colorful, while the majority said that they were already beautiful as such and there was no need for any change. The students stated that there were no sections in the comic book that bored them or that they wanted to remove. These opinions of the students were included in the "Change request status" sub-theme, and an exemplary student response related to this issue is presented below.

> "I don't want to change any section. It's already entertaining as it is. This is fine." (S9, Boy)

Further illustrations (f=5) and text-illustration balance (f=2) codes were grouped under the "Illustrations" sub-theme. The students stated that they were positively influenced by the illustrations and the humorous elements supporting the subjects in the comic book. They further expressed that the text-dominant content of the textbooks was boring and suggested comic books be used in courses other than science. Further illustrations were found to be the most repeating code under the "Illustrations" sub-theme. These opinions of the students were included in the "Illustrations" sub-theme, and an exemplary student response concerning this issue is provided below.

> "I really loved the comic books because of the picture content. I like the illustrations. Text-heavy books seem a little boring." (S1, Boy)

Context (f=2) and Style (f=2) were the two codes grouped under the "Structure" sub-theme. Students stated that they were very impressed and excited by the illustrations and the context when they read the comic book. As the underlying reason for this situation, they pointed out that the illustrations included in the structure of the comic book are quite effective in complementing the information presented in the

writing. Furthermore, the presentation of the information aimed to be taught within the scope of the science courses in connection with daily life and accompanied by adventures turned the comic book into a course material different than the textbooks that students were used to. This fact was included in the "Structure" sub-theme, and an exemplary student response concerning this issue is presented below.

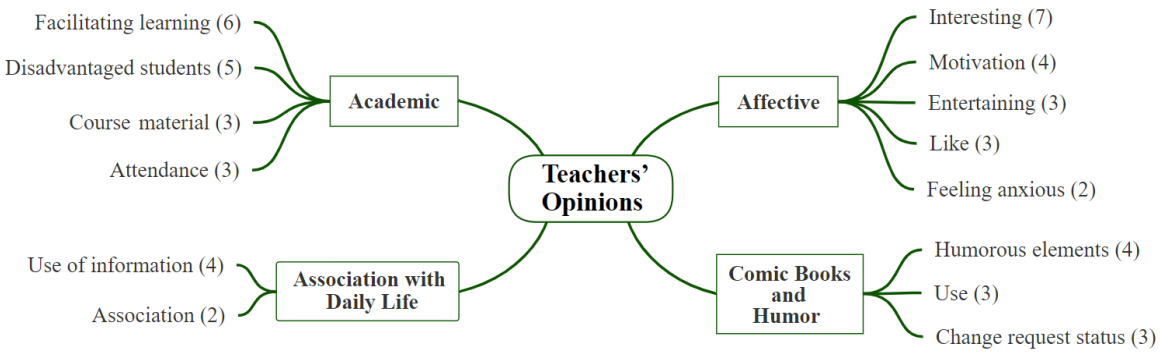
> "I was getting excited while reading the comic book. The comic book sounded very exciting because of the script, the illustrations, and what it was telling. It was quite different and beautiful compared to our own textbook." (S1, Boy)

Science Teachers' Views on Context-Based Comic Books

As a result of the analysis of the data obtained from the implementing course teacher, the opinions about the CBC Books and the implementation process were examined under the themes of "Academic," "Affective," "Association with Daily Life," and "Comic Books and Humor." The classifications related to the themes and sub-themes derived in accordance with the opinions of the implementing course teacher are presented in Figure 5.

Figure 5

Course Teacher's Views on CBC Book and Its Implementation



Theme "Academic"

Theme "Academic" comprises Facilitating learning, Disadvantaged students, Course material, and Attendance sub-themes. The course teacher was asked questions concerning the effects of teaching lessons with CBC Book on students' learning. The use of illustrations and texts (f=3), Adventures (f=2), and Entertaining teaching (f=1) codes were derived based on these questions, and these codes were then grouped under the "Facilitating Learning" sub-theme. The course teacher said that the adventures in the comic book, the humorous elements included in its structure, and the topics and concepts discussed are supported by illustrations which allow students to better learn the related topic. An exemplary response concerning the "Facilitating Learning" sub-theme is provided below.

> "... the events, topics, and concepts decoded in the comic book were motivating; the students learned better when these came together. Sometimes students get tired of reading a long text, they leave it aside without finishing, but the student reads a comic book to the end."

Implementing course teacher was further asked whether there were disadvantaged students in the class and the status of these students in the courses taught using the CBC Book. Reading difficulties (f=3) and Foreign national students (f=2)

codes were reached based on these questions, and these codes were grouped under the "Disadvantaged students" sub-theme. Implementing course teacher stated that there was a student with literacy difficulties in the classroom and a foreign national student who could not fully understand Turkish. The teacher further indicated that teaching the courses using comic books improved the participation of disadvantaged students in the courses. The underlying reason for this situation was explained as the fact that these students could make inferences about the subject under consideration as the texts were supported by illustrations even though they could not fully comprehend the statements contained in the texts. The teacher's response concerning the "Disadvantaged students" sub-theme is presented below.

> "... students with literacy problems and most foreign national students may already have problems understanding Turkish. How far can you reach out to a student by trying to teach science to a student who already doesn't know Turkish well enough. For example, I have a student "H" who has problems in reading and writing; this is the first time I've seen him participating so much in class. Illustrations also have an instructive effect. The student is trying to understand what is happening by following the illustrations even if s/he does not know how to read and write. This indicates that the student can learn better when supported by illustrations. We also have foreign national students, and we have difficulty teaching subjects because, as I said before, these students do not sufficiently know the language. They were following the lesson in spite of these disadvantages. The student makes the inference that this happened here, this happened there by just looking at the illustrations."

Details (f=1), Presentation of the information (f=1), and Interesting (f=1) codes were grouped under the "Course Material" sub-theme. The course teacher provided reasons why the comic book could be utilized as a course material, such as offering additional details not covered in the textbook that should be highlighted by the instructor, accompanied by examples from everyday life relevant to the discussed topic. The teacher also noted that the illustrated content of the comic book enhances the learning experience. In addition, by the end of the implementation, the teacher conveyed that the students rather enjoyed the comic book as they expressed a desire for future units and courses to be taught using this method and showed interest in having textbooks prepared in comic book format. An exemplary teacher's response concerning the "Course Material" sub-theme is presented below.

> "When compared with the textbook, we can even say that the comic book alone is sufficient enough. I even think that the comic book is somewhat more advantageous than the textbook. For example, we teach the textbook of the 5th grade in other classes, and the student may have difficulty in comprehending the relevant concepts covered in the topic. The comic book provides better access to the prepared contents compared to the textbook. However, when the textbook is used, the student may have difficulty deriving the concepts. I think that the exam group students will be more successful in case CBC Book method is implemented in the 8th grade. I think it will improve academic success."

Indifferent students (f=2) and Attracting interest to the course (f=1) codes were grouped under the "Attendance" sub-theme. Implementing course teacher stated that CBC Book draws the attention of students to the lesson and that even the students with a poor interest in previous lessons could adapt and actively participate in the lesson taught. They further said that foreign national students and students with reading difficulties actively followed the course, and that CBC Book had a positive effect on their participation in the course. An exemplary teacher's response concerning the "Attendance" sub-theme is presented below.

> "... there are necessarily students in every class who have little to do with the lesson; even students who had little interest in the lesson taught before tried to participate in the lessons taught using the comic books."

Theme "Affective"

The sub-themes of Interesting, Motivation, Entertaining, Like and Feeling anxious are grouped under the current theme. Interesting content (f=4), interesting illustration (f=2), and interesting material (f=1) codes were grouped under the "Interesting" sub-theme. The course teacher stated that he had previously read comics at different levels that were unrelated to lessons. He found the comic books interesting but had never thought that they could be used in teaching. The teacher said that the comic books attracted the students' interest in the lesson due to their features, such as structure, content, illustrations, and humorous elements. He further said that he made extra effort to attract the children's interest in the lesson in other classes; however, there was no need for such an effort thanks to the use of comics in the implementation class. It was emphasized that comic books served as an effective course material in capturing students' interest, particularly when teaching subjects and concepts that students typically showed indifference towards. An exemplary teacher's response concerning the "Interesting" sub-theme is presented below.

> "... the use of the comic book in the lesson provided great convenience. It requires additional effort to draw the students' attraction to the lesson in other classes. However, in the present case, all the children raise their fingers as soon as we start the lesson. In the implementation class, we can draw the students' attention directly into the subject without making any extra effort, but in the other classes, it is necessary to give extra examples to the students."

The motivation sub-theme consists of a combination of Motivating structure (f=2) and Motivating script (f=2) codes. The course teacher stated that factors such as the way the courses taught with comic books dealt with the subject, the content and structure of the CBC Book, and the inclusion of humorous elements motivated the students. The teacher's response concerning the "Motivation" sub-theme is presented below.

> "... the most difficult and most essential part is to draw the student's interest to the lesson. This situation takes up a significant part of our time in a standard course flow. We are just trying to draw the student's interest to the subject in the first 10-15 minutes. But when comic books are concerned, the examples, drawings, illustrations, and visuals combined with the text directly motivate the child. And that made it easy for us. Having attracted the child's attention to the lesson and providing high motivation yielded positive results. When we give the information/knowledge to the student, accompanied by life stories and adventures quoted from everyday life, and when we finalize the teaching activity with an assessment at the end, I really think that the student learns the subject very well."

Amusing (f=2) and Laughter (f=1) codes were grouped under the "Entertaining" sub-theme. The course teacher conveyed that students found the CBC Books entertaining due to factors such as humorous elements included in the script, illustrations supporting the narrated topic, and associations with everyday life. Furthermore, the teacher stated that students found something of themselves in the comic books, that they exhibited positive reactions during and at the end of the implementation, and that they wanted the implementation to be repeated with comics with similar content because they enjoyed the experience. The teacher's response concerning the "Entertaining" sub-theme is presented below.

> "I think that the comic book attracted the attention of students in the lessons not only because of its structure but also due to its content, so it was really entertaining to teach a lesson with a comic book."

Happiness (f=2) and Satisfaction (f=1) codes were grouped under the "Like" sub-theme. The course teacher said that students liked the CBC Books and that they were happy to use them in classes. The students also stated that they wanted other units in the science course to be taught using comic books. The teacher's response related to the "Like" sub-theme is provided below.

> "The students liked the comic book very much and were always happy throughout the implementation. They told us that they wished other units to be taught using the comic books method. They also suggested the textbooks be prepared similarly. The stories, illustrations, and quotes from daily life in the comic books better motivated the students in the lesson; the students almost found themselves in these elements. I've always had positive feedback."

Anxiety (f=1) and Use in teaching (f=1) codes were grouped under the sub-theme of "Feeling anxious," and the opinions of the implementing course teacher presented before and after the lessons lectured using the CBC Book were included herein. The course teacher had initial thoughts that teaching with CBC Books could be entertaining but also expressed concerns about difficulties students might face in learning the subject. The teacher further stated that he was curious about the reactions from the students, but the positive reactions from the students dispersed the concerns about the learning performance of the subject. An exemplary response concerning the "Feeling anxious" sub-theme is presented below.

> "Before the implementation, I had concerns about how the lessons would be, whether it would be just entertaining or whether we could teach the subject effectively. I was really wondering what kind of result would turn out in the end, but when I started the implementation, I realized how beautiful it was; my worries disappeared. I noticed that students are learning the subject better."

Theme "Association with Daily Life"

The sub-themes under this theme are the use of information and association. The learning outcome of the information (f=3) and Problems encountered (f=1) codes were grouped under the "Use of information" sub-theme. Implementing course teacher indicated that the association of events taking place in everyday life with the topic under consideration and presenting them to the students supported by speech bubbles and illustrations within a scenario has given the students the opportunity to see the correspondence and usage areas of the information/knowledge acquired in their daily lives. The teacher further stated that the students' interest in the course was high both because of the humorous elements and the opportunity to come across the correspondence and usage areas of the information/knowledge acquired in their daily lives. An exemplary response concerning the "Use of information" sub-theme is presented below.

> "... when, under normal circumstances, we give a certain information/knowledge to a student, they have always questioned what this information would be useful for; now that they have got the answer to that in the comic book. I think that's the main benefit of the comic book. For this reason, the student was much more motivated and learned better."

Association with daily life (f=1) and Association with the immediate environment (f=1) codes were grouped under the "Association" sub-theme. Implementing course teacher stated that a student finds the opportunity to see the equivalent of the knowledge acquired at school when he goes outside the classroom as

the examples included in the comic book are taken directly from everyday life. It was further reported that students had realized the equivalent of the information/knowledge they have acquired in the lessons taught with comic books in the environments they visited outside the school and that they have shared this experience in the classroom by establishing the necessary associations. An exemplary teacher's response concerning the "Association" sub-theme is presented below.

> "... as the samples taken from daily life are placed inside the comic book, the student knows that they may encounter such examples when they go outside. One of our students shared the experiences at home with us in the classroom. Another student mentioned putting on the brake while riding the bike, slipping over, and falling and, as a result of this incident, immediately remembering the topic covered in the lesson. He even said that the friction force was relatively less in the situation he experienced, and he gave an example. So, the examples included in this comic book make positive contributions to the transfer of knowledge."

Comic Books and Theme "Humor"

The current theme includes humorous elements, use, and change request status sub-themes. Contribution of funny events (f=2), Attraction of funny events (f=1), and Entertainment of funny events (f=1) codes were grouped under the "Humorous Elements" sub-theme. The implementing course teacher stated that the students thoroughly enjoyed the sections of the comic books where the humorous elements were prominent during the reading process. It was further stated that the inclusion of these sections in the comic book had attracted the students' attention to the lesson, and thus they better understood the subject. An exemplary teacher's response concerning the "Humorous Elements" sub-theme is presented below.

> "... Students particularly had fun in the episodes of the journey to the village at the beginning of the story, the disputes of the siblings, the episode of the car race, and the section where the siblings broke down the dynamometer. We've focused on these issues; we've received positive feedback, and the children really liked it. Although they were given the opportunity to make a dynamometer from scratch, the students were more interested in the subject when covered in the comic book in the form of an adventure."

Contribution of the illustrations (f=2) and the Use in other units (f=1) codes were grouped under the "Use" sub-theme. The implementing course teacher said that the drawings in the comic book attracted the attention of the students, and the illustrations provided a better understanding of the subject. Furthermore, it was reported that there were no difficulties encountered in using the comic books and that similar comics could be easily employed for other units. An exemplary teacher's response regarding the "Use of the Comic Book" sub-theme is provided below.

> "... thanks to the comic book, students have more easily adapted to the lesson. Not only the children found something of themselves, but also the illustrations have quite attracted attention. I also had concerns about the outcome before the implementation, but then I saw how successful it was. I noticed that children are learning the subject better; so, I think that new comic books suitable for other units, if prepared, can also be used in those units."

Implementing course teacher was asked whether there was any amendment that he wanted to make to the CBC Book used during the lesson, but the answer revealed that the current CBC Book used was sufficient and there was no need for any amendments. Applicable (f=2) and Sufficient (f=1) codes were generated based on these answers, and these codes were grouped under the "Change request status" sub-theme. It was mentioned during the interviews that some of the students expressed a desire for the comic book to be colored. However, when asked about the potential

impact of coloring the comic book during the implementation, it was stated that no significant differences were expected. Therefore, it was concluded that the comic book could remain in its current form. An exemplary teacher's response concerning the "Change request status" sub-theme is presented below.

> "... maybe it will be different if the comic is colored, but the black and white version that we currently use also has a different taste. I don't think there's any need for a change."

Discussion and Conclusion

After the teaching implementation was carried out using the CBC Book, interviews were held with the implementing course teacher and seven students who participated in the implementation. As a result, the opinions of the implementing course teacher and the students were grouped under four main themes: Academic, Affective, Association with daily life, and Comic Books and Humor.

Under the theme "Academic," the academic dimensions of the CBC Book from the viewpoint of students and teachers were examined in depth. In this regard, issues such as the comprehensibility of the CBC Book for students, its impact on learning, its usability in different units and courses, and the possibilities of personal follow-up for absent students were examined. The issues examined from the perspective of the implementing course teacher included the students' participation in the course, its impact on their learning performance, its usability as course material, and its usability for disadvantaged students. Students stated that they sometimes faced difficulty in understanding the expressions in the textbooks or different course materials when they read them, requiring them to read them multiple times. However, the presentation of the texts described in the CBC Book, as supported by illustrations, provided an elaboration of the topic under consideration, and in this way, they could understand the related topic more easily without experiencing difficulties. Owing to the use of comic books in teaching, the topic to be narrated is illustrated based on real life, making the topics and concepts discussed more comprehensible by students (Affeldt et al., 2018). That is, the use of comics allows students to realize how to relate the topic to real life and experience the moments to be vocalized as 'A-ha!' (e.g., Kurnaz & Çalık, 2008; Metcalf & Tinker, 2004).

Presenting text and illustrations to students using the CBC Book in a way that complements each other in harmony ensured the topics and concepts covered were more comprehensible by students. Implementing course teacher also expressed an opinion in support of this situation. Accordingly, he said that the adventures in the comic book, the humorous elements included in its structure, and the topics and concepts discussed were supported by illustrations which allowed students to better learn the related topic. Students understand better if a text captures their interest (Schiefele et al., 2012). It is known that the use of comic books in lessons draws the attention of students with low interest in the lesson (Cheesman, 2006). In addition, including examples and contexts related to daily life in the lessons also attract interest in the lesson (Ültay, 2014). For the purpose of the current study, it was also determined that the CBC Book attracts the attention of students allowing them to adapt to the lesson. Even the students with low interest were found to participate in the lesson taught using the CBC Book.

Implementing course teacher stated that there was a student with literacy difficulties in the classroom and a foreign national student who could not fully

understand Turkish. The comic book comprises a mixture of illustrations and texts in its structure and addresses its reader using a different language (Groensteen, 2007). In light of these considerations, it was observed, as stated by the implementing course teacher within the scope of the current research, that teaching the lessons using comic books improved the participation of disadvantaged students in the lessons, and students understood the topics better compared to the lessons taught without using any comic books. The fact that comic books are interesting and intriguing even for illiterate children (Afrilyasanti & Basthomi, 2011; Yüzbaşıoğlu & Kurnaz, 2022a) explains the teaching implementation using the CBC Book with foreign national students who have difficulties in reading and writing along with the problems of establishing meaning in Turkish. The inclusion of interesting illustrations in the CBC Book, as reported by the students interviewed in the current research, sparked curiosity and promoted active engagement in the lessons. Similarly, Rota and Izquierdo (2003) stated that the comic book reader is active in the learning process. The readers are further reported to make efforts to establish the relationship between the illustrations and the text within the process of being active in this lesson. In the lessons taught with the CBC Book, disadvantaged students were found to be able to make inferences about the subject being discussed, although they could not fully understand the expressions in the texts because the texts were supported by illustrations.

Among the students interviewed, there were some who stated that they had read the comic book before, and despite the passage of time, they retained a lasting memory of the subject of the comic book. Students were found to have difficulty remembering the subject and content of different books they read, whereas they clearly remembered the comic book and its topic. Comic books contribute to the comprehension of the presented information by students and provide an opportunity for permanent learning (İlhan, 2016; Kurt, 2019; Mutlu, 2019). The fact that students are more likely to remember the comic books that they had read at a younger age and their contents compared to other books supports this finding.

The students stated that they personally tried to make up for their deficiencies on the days they were absent and when they could not go to school by reading the comic books for the science course and the textbooks of the related course for the other courses. They further said that they effectively made up for the science lessons lectured on the days they were absent thanks to the comic books. However, there were subjects that remained misunderstood in other courses. There were findings in the literature supporting this suggestion, indicating that students needed supplementary course materials to better understand the subject after the lessons taught by traditional methods adhering to the textbook, whereas they did not have such a need after the courses taught using comic books (Çiçek Sentürk, 2020). Individuals may overlook the information provided while reading texts that do not draw their interest or are not motivating, and they try to finish the text quickly. The fact that other textbooks published at this age remain insufficient to attract the attention of students may make it difficult for students to make sense of some sections when they read them individually. The use of comics in the teaching environment, compared to traditional practices, offers the opportunity to enrich learning experiences and encourages the active participation of students in the teaching process (Affeldt et al., 2018; Lazzarich, 2013). Based on the statements of the students saying that they understand the subjects more easily when they read the CBC

Book individually at home on the days when they are absent compared to other textbooks, it can be suggested that comic books can be used as an effective teaching tool when students personally assume their own learning responsibilities.

Students stated that all the units taught in the science course could be lectured using similar comic books. In relation to this, the first priority preferences of the students were the units entitled Matter and Change of State, the World of Living Creatures, and the Electrical Circuit Components. When the students were further asked which other courses they would like to use the CBC Books, they all preferred the social sciences course. Some of the students said that comic books could be used in Turkish and Mathematics lessons in addition to social sciences. The reasons students expressed for preferring these courses were the predominance of text-based lessons and the requirement to take notes. Therefore, students stated that using comic books in the lessons would make them more enjoyable and improve their understanding of the topics. Textbooks alone may be insufficient in attracting and maintaining students' interest in the course, as most of their content is written texts. Incorporating comic books, in which the information/knowledge presented as text is supported by illustrations, will be essential to eliminate this situation (Ünal, 2018). The fact that students want to use the CBC Books in other units and courses also supports this proposition. Implementing course teacher suggested comic books to be used as a course material on the grounds that a comic book offers details that are not included in the textbook and that should particularly be mentioned by the instructor along with many examples taken from everyday life in the narration of the relevant topic and that the narrated topics are supported by illustrations. The literature review revealed that the use of the comic book as course material contributes positively to students' academic success (Topkaya, 2014), encourages class participation (Kurt, 2019), and contributes to the comprehension of the information presented by the students and permanent learning (İlhan, 2016; Sarıbıyık, 2018). Based on these considerations, it is possible to conclude that the CBC Books may be used as effective course materials on the grounds that it makes the subject matter entertaining and understandable, facilitates learning, provides an opportunity for a permanent learning experience and individual learning, encourages class participation, and supports the learning processes of students with literacy and language problems. Studies also revealed that there were similar research findings supporting this proposition where courses such as Citizenship and Democracy (Topkaya, 2014), Social Sciences (İlhan, 2016; Ünal, 2018), and Physics (Orçan, 2013) were taught using comic books as teaching materials.

Theme "Affective" was derived based on the opinions of the implementing course teacher and students about the CBC Books. The students stated that they were excited at the moment they saw the comic book for the first time, that they could not fully understand its relevance to the lesson, and that they were curious about its content. They further said that they found the dialogues between the characters and the events that took place within the scope of the story very entertaining, and it was enjoyable to read them. The use of comic books encourages students to read (Wood, 2015). A similar result was obtained in the current research, and the students said that they liked the illustrations and the script of the comic book, expressed that reading comic books made them happy and that they finished the CBC Books quickly because they were curious about the ending. The reactions of the characters featured in the comic book to the

events and situations related to daily life are effective in the comic book reader's association with the character and in making sense of the scenario (Alsaç, 1994; Cantek, 2014; Kireççi, 2008; Tuncer, 1993). Appropriate context selection enables students to relate the concepts to their own lives (Ültay, 2014). For the purpose of the current research, the students interviewed stated that the illustrations and speech balloons in the CBC Book made them feel like they were in the place where the story was narrated, allowed them to put themselves in the shoes of the characters and dream and to feel like they were saying the expressions in the speech balloons to someone who was in front of them. They further expressed that they internalized the subject while the lesson was taught, and thus, they were not bored. The inclusion of comic books in the lessons makes learning interesting for students and ensures them to be happy and eager for the lesson (Orçan, 2013; Tatalovic, 2009). In fact, it was found that using the CBC Book in the corresponding unit, along with the inclusion of humorous elements in the script, led to enjoyable learning experiences for the students, making them feel happy.

Implementing course teacher stated that he had previously read comics at different levels that were unrelated to lessons. He found the comic books interesting but had never thought that they could be used in teaching. The teacher further said that he estimated teaching with CBC Books might be entertaining, but he was also concerned about whether the students would have difficulties learning the subject. The reactions of the students worried him/her before the implementation; however, the positive reactions received from the students dispersed the concerns about the learning performance of the subject. The use of CBC Books in lessons was determined to be attracting the attention of students as well as to be entertaining and motivating towards the lesson due to factors such as the humorous elements included in the scenario along with the fact that the topic being narrated is supported by illustrations and associated with everyday life. There are studies in the literature that support this situation, stating that the use of comics in lessons improves the interest in the lesson, provides motivation, and contributes to learning new information (Çiçek Şentürk, 2020). Comic books are used in science lessons because they include interesting stories (Spiegel et al., 2013) and make the lesson more entertaining (Olson, 2008). The interviews held enabled us to conclude that the students wanted similar new implementations as they found something of themselves in the comics and had fun. İlhan (2016), who reached a similar conclusion, found that students who studied using comic books as course materials for the first time wanted to use them in their other courses as well.

The issues analyzed within the context of the theme "Association with Daily Life" from the students' point of view were the association of the information included in the CBC Book with everyday life, the ability to apply the acquired information into practice, and the use of the acquired knowledge. The issues analyzed from the implementing course teacher's point of view were the effectiveness of the teaching implementation using the CBC Book in helping students recognize the practical application of acquired information/knowledge in their learning environments and connecting them to real-life situations or events was assessed. The course teacher indicated that the association of events taking place in everyday life with the topic under consideration and presenting them to the students supported by speech bubbles and illustrations within a scenario had given the students the opportunity to see the correspondence and usage areas of the information/knowledge acquired in their daily

lives. The teacher further stated that the students' interest in the course was really high both because of the humorous elements and the opportunity to come across the correspondence and usage areas of the information/knowledge acquired in their daily lives. Hırça (2012) concluded that the topics covered in the lessons become more comprehensible for students when explained using examples from everyday life and that students develop a positive attitude towards the lesson. This finding supports the opinion of the implementing course teacher stating that the students' interest in the lessons lectured using the CBC Book is high. Furthermore, the students expressed similar opinions with the implementing course teacher and stated that the topics covered in the comic book during the lessons lectured with CBC Book consisted of situations that they had encountered or may encounter in their daily lives. The examples provided related to daily life are more easily understood by individuals (Rose, 2012; Taşkın & Moğol, 2017). Accordingly, it was found that students did not have any difficulty understanding the information included in the CBC Book and thought that this information was quite easy to understand. Students said that they could use the information/knowledge acquired in the lessons with the CBC Book to explain the reason for an incident that happened while chatting with their friends or family or while solving a problem they encountered in their close environment. The curriculum of the science course requires the students to use the knowledge and skills acquired in the course to solve everyday life problems (MoNE, 2018). In this regard, the students were found to be able to use the information acquired in the lesson to solve the problem situation similar to or different from the events encountered in the comic book scenario or explain the reason for it. Based on this finding, it is possible to argue that the courses taught using the CBC Book contribute to the realization of the specific goals defined in the curriculum.

The students reported that CBC Book, supported by dialogues and illustrations, provided them the opportunity to observe the equivalents of the acquired subjects and concepts in daily life. Canlas (2021) suggested that contexts should not be limited to the subject that students learned and that different contexts should also be used. Diversifying the contexts related to a certain concept will also prepare individuals for different problem situations. The use of contexts that are not relevant to students' daily lives can hinder their understanding (Bozdemir Yüzbaşıoğlu et al., 2020; Mustafaoğlu, 2019). The events presented in the CBC Book scenario were prepared by taking into account the possible environmental conditions in which students have been or may be present. Accordingly, the feedback received from the students and the course teacher revealed that the contexts in the structure of the comic book were clearly understood. Students stated that they had the opportunity to learn the working principle of the dynamometer while the characters in the comic book were picking apples in the village garden, the use of thin and thick springs in the dynamometer when the characters disrupted the elasticity of the dynamometer spring in the schoolyard and to observe all of these topics with examples of everyday life. The illustrations in the CBC Book enabled the related topics to become more concrete in the minds of the students. Previous studies supported this finding revealing that the use of context-based teaching materials in the lesson ensures the students to better comprehend the topics and helps them to materialize abstract concepts (Aşkın Tekkol & Bozdemir Yüzbaşıoğlu, 2022; Kistak, 2014; Tekbıyık, 2010; Ültay & Ültay, 2012).

Pursuant to the curriculum of the science course, the unit entitled Measurement of Force and Friction aims to teach students how the magnitude of the force can be measured using a dynamometer, to enable students to observe the effect of frictional force on movement on different surfaces, to make students aware of the significance and importance of friction force in daily life and to provide students creative and innovative thinking skills by allowing them to combine the knowledge they acquired about increasing and reducing the friction force with their own ideas (MoNE, 2018). Kara (2016) stated that context-based course materials helped students to acquire information that they can use in daily life in the lessons and that this information is more permanent in their minds. Students interviewed in the current research stated that they had the opportunity to put the knowledge they acquired during the CBC courses into practice by using the materials or tools they found in their close environment. In this regard, the students developed a dynamometer using the materials they found, made measurements with the dynamometer they found when they went to the village or drove their toy cars or bicycles in different environments to compare/observe the effect of frictional force. In this way, they also had the opportunity to observe the different applications of the information they acquired at school. Individuals tend to produce solutions to problems much more easily if they are familiar with them from their daily lives compared to other scientific problems (Whitelegg & Parry, 1999). One of the reasons why students cannot offer solutions to the problems they encounter in their daily lives is that they cannot transfer the information acquired at school to their daily lives (Burbules & Linn, 1991). The course teacher expressed that a student finds the opportunity to see the equivalent of the knowledge acquired at school when he goes outside the classroom, as the examples included in the comic book are taken directly from everyday life. It was further reported that students realized the equivalent of the information/knowledge they acquired in the lessons taught with comic books in the environments they visited outside the school and that they shared this experience in the classroom by establishing the relevant associations. Accordingly, the students included in the current research connected real-life events they encountered with the information taught through the CBC Book, provided explanations or carried out various applications within the bounds of their possibilities. Based on these findings, it is possible to argue that CBC Book contributes to students' ability to see the use of the information they acquired in daily life, allowing them to make the necessary associations and use them in possible situations.

The theme "Comic Books and Humor" explored whether the students wanted any amendments with regard to the structure, illustrations, or humorous elements of the CBC Book and their opinions about the continuation of the use of comic books and the implementing course teacher's views about the use, humorous elements, and the amendments on the CBC Book. Students stated that they were very impressed and excited by the illustrations and the context when they read the comic book. The use of illustrations along with texts for the narration of the subject covered in comic books has been known to capture individuals' attention (Green & Myers, 2010; Hutchinson, 1949; Ünal, 2018). Accordingly, students pointed out that the illustrations included in the structure of the CBC book were quite effective in complementing the information presented in the writing. Students find lessons taught with context-based materials interesting when the course materials are rich in illustrations and include problems that

are relevant to their daily lives (Akbulut, 2013). The humorous elements of the comic book are known to attract the attention and interest of individuals (Çiçek Şentürk, 2020; Lin et al., 2015; Topkaya & Şimşek, 2016). Students said that they were much more entertained when learning a certain subject while two brothers were saying bandy words to each other, while they were racing with each other, while school friends were saying bandy words to each other, and in the episodes where other humorous elements were predominant. Implementing course teacher similarly stated that the students had fun in the sections where the most humorous elements were frequent while reading the comic books. In addition to the illustrations and humorous elements included in the structure of the comic book, the presentation of examples from everyday life in the teaching environment further motivates students for the lesson (Çiçek Şentürk, 2020). Accordingly, the presentation of information in connection with everyday life accompanied by adventures for the purpose of the current research turned CBC Book into a course material in a different style than the textbooks that students were used to serve to present the "Ha-ha!" of humor together with the "A-ha!" of learning. In the courses taught using materials prepared according to the context-based approach, students expressed that these materials led them to think, to better understand their environment, and to gain problem-solving skills because the lessons were related to daily life (Tulum, 2019). In the current research, students also stated that CBC Book is both entertaining and informative.

It was concluded that students waited for the next lesson with enthusiasm when the course was designed according to the context-based approach and that this method encouraged their participation in the lesson (Karslı & Yiğit, 2017). The students interviewed in the current research stated that they liked the structure of the CBC Book, they were entertained when they read it, and that they better understood the subject intended to be taught; so, they wanted to read similar comics. The use of comic books has the potential to reduce the amount of text presented to the students and to associate the information taught with everyday life (Affeldt et al., 2018). Owing to the illustrations and texts included in their structure, comic books have the potential to offer more information to students in an entertaining way compared to traditional textbooks (Hosler & Boomer, 2011). The students stated that the text-dominant content of the textbooks was boring and suggested comic books be used in courses other than science. Some of the students interviewed revealed that they looked for similar comic books in the bookstores, and they found examples of comic books that were not related to the lessons, but they had difficulty finding comics that were directly related to their lessons. The students were further asked which amendments they would like to make to the comic book. Some of them said that the comic books could be colorful, while the majority stated that they were already beautiful as such and there was no need for any amendments. The students stated that there were no sections in the comic book that bored them or that they wanted to be removed. They further said that they would like to have comic books in which the characters are the same, but there are adventures related to different course subjects. Implementing course teacher was asked whether there was any amendment that he wanted to make to the CBC Book used while teaching the lesson, but the answer revealed that the current CBC Book used was sufficient and there was no need for any amendments. The teacher was further asked whether any differences would occur during the implementation in the case of using colored comics

as suggested by some of the students, but the teacher's opinion stating said he would not expect any difference, so the CBC Book could remain as it was considered to be significant.

Based on all these findings, CBC Book was appreciated by both students and the implementing course teacher in terms of its academic, and affective, ability to associate information with everyday life and structural features, and it was concluded that further episodes of CBC Book would satisfy both students and teachers. The courses taught through the CBC Book were found to improve students' interest in the lesson and enabled them to put the knowledge they acquired into practice in their daily lives and to do activities at home without any homework being assigned by the teachers. Supporting students' interest in daily life in educational environments is known to positively affect their interest in science (Siverton, 1993). Effectively conducted science education will serve to develop individuals' research skills, help students to understand the significance of science, and will ensure them to be raised to become future scientists (Slavin et al., 2014). For this reason, students of this age should experience more than watching a bean planted in a glass grow in the classroom environment (James B. Hunt, Jr. Institute for Educational Leadership and Policy, 2007). In this way, students will have the opportunity to transfer the knowledge they acquired at school to new situations and to offer solutions to the problems they encounter in their daily lives.

The CBC Book prepared within the scope of the research served to break down the walls of the school environment and to lift the lid off between the classroom and real life. Interviews held with a teacher and students revealed that the CBC Book prepared within the scope of the research allowed them to answer the question, "What will I do with this information?". The humorous aspect of the CBC Book and the humorous elements presented in its content were found to capture the students' attention. It should not be forgotten that there is a close relationship between the "Ha-ha!" of humor and the "A-ha!" of learning.

It is possible to conclude that the CBC Book may be used as an effective course material for further units and courses on the grounds that it makes the subject matter entertaining and comprehensible, facilitates learning, provides an opportunity for a permanent learning experience and individual learning, encourages class participation and supports the learning processes of students with literacy and language problems. Comic books can also be prepared and used in lessons that students are biased about learning, have difficulty understanding, and find boring or abstract. Furthermore, course teachers may be provided practical training on the preparation of comic books and their use in teaching environments.

Acknowledgements

The authors would like to thank all participants.

Statement of Responsibility

Mustafa Kemal Yüzbaşıoğlu; design of the research process, conceptualization, writing, methodology, selection of data collection tools, data collections, data analysis. Mehmet Altan Kurnaz; advising, design of the research process, writing, review and editing, methodology, selection of data collection tools, data analysis.

Conflicts of Interest

The authors declare no conflict of interest.

Author Bios:

Mustafa Kemal Yüzbaşıoğlu is a science teacher at the Ministry of National Education. His current research interests are science education, sustainable development, context-based learning, comics.

Mehmet Altan Kurnaz is a Professor in the Department of Mathematics and Science Education at Kastamonu University. His current research interests are physics education, science education, grounded mental model theory, models and modelling, alternative ideas, context-based learning.

References

Affeldt, F., Meinhart, D., & Eilks, I. (2018). The use of comics in experimental instructions in a non-formal chemistry learning context. *International Journal of Education in Mathematics Science and Technology, 6*(1), 93-104. doi: 10.18404/ijemst.380620.

Afrilyasanti, R., & Basthomi, Y. (2011). Adapting comics and cartoons to develop 21st century learners. *Language in India, 11*(11), 552-568.

Akbulut, Ö. E. (2013). *Dokuzuncu sınıf kuvvet ve hareket ünitesine yönelik bilgisayar destekli bağlam temelli öğretim etkinliklerinin incelenmesi [The investigation of computer aided context-based teaching activities for 9th grade force and motion unit]* [Doctoral dissertation]. Karadeniz Technical University.

Akbulut, H. İ., & Çepni, S. (2013). Bir üniteye yönelik başarı testi nasıl geliştirilir? İlköğretim 7. sınıf kuvvet ve hareket ünitesine yönelik bir çalışma [How to develop an achievement test for a unit? A study for grade 7 force and motion unit]. *Amasya Education Journal, 2*(1), 18-44.

Akın Yanmaz, E. (2021). *Bağlam temelli öğrenme yaklaşımına göre geliştirilen rehber materyallerin ortaokul 7. sınıf öğrencilerinin kavramsal anlamaları üzerine etkisi: "Aynalar ve ışığın soğurulması" örneği [The effect of guide materials developed according to context-based learning approach on the conceptual understanding of 7th grade students: "Mirrors and absorption of light"]* [Master's thesis]. Giresun University.

Alsaç, Ü. (1994). *Türkiye'de karikatür, çizgi roman ve çizgi film.* İstanbul: İletişim

Aşkın Tekkol, İ., & Bozdemir Yüzbaşıoğlu, H. (2022). İlkokul ve ortaokul fen bilimleri ders kitaplarının günlük yaşam ile ilişkilendirilmesinin incelenmesi. T. Çetin, G. Kılıçoğlu & E. Sözen (Eds.), Eğitimde kuramsal ve uygulamalı akademik araştırmalar 1 (pp.435-451). İstanbul: Hiper Yayın.

Bennett, J., Lubben, F., & Hogarth, S. (2007). Bringing science to life: A synthesis of the research evidence on the effects of context-based and STS approaches to science teaching. *Science Education, 91*(3), 347-370.

Bennett, J. (2016). Bringing science to life: Research evidence. In Taconis, R., den Brok, P., & Pilot, A. (Eds.), *Teachers creating context-based learning environments in science* (pp. 21-41). Rotterdam: Sense.

Bozdemir Yüzbaşıoğlu, H., Ezberci Çevik, E., & Kurnaz, M. A. (2020). Fen bilgisi öğretmen adaylarının yansıma ve kırınım konusundaki bağlamlaşmış bilgileri

[*Contextualized knowledge of pre-service science teachers on reflection and diffraction*]. *Van Yüzüncü Yıl University Journal of Education, 17*(1), 722-740.

Burbules, N. C., & Linn, M. C. (1991). Science education and philosophy of science: congruence or contradiction? *International Journal of Science Education, 13*(3), 227-241.

Canlas, I. P. (2021). Using visual representations in identifying students' preconceptions in friction. *Research in Science & Technological Education, 39*(2), 156-184.

Cantek, L. (2014). *Türkiye'de çizgi roman.* İstanbul: İletişim.

Cheesman, K. (2006). Using comics in the science classroom. *Journal of College Science Teaching, 35*(4), 48-51.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches.* Sage Publication.

Çelik, B. (2021). *Fen bilimleri öğretmen adaylarının madde ve ısı ünitesinde hazırlanan bağlam temelli öğrenme etkinlikleri hakkındaki görüşleri [The views of pre-service science teachers about the activities of context-based learning in the matter and heat unit]* [Master's thesis]. Erciyes University.

Çiçek Şentürk, Ö. (2020). *Argümantasyon destekli eğitici çizgi romanların öğrencilerin çevreye yönelik ilgi, motivasyon ve akademik başarılarına etkisi ile öğrenci deneyimleri [The effect of argumentation-supported educational comics on students' environmental interests, motivation, and academic achievements and student experiences]* [Doctoral dissertation]. Gazi University.

Doğan, H. (2020). *Beşinci sınıf fen bilimleri dersi ünitelerinin bütünleşik STEM eğitimi yaklaşımı ile tasarlanması, uygulanması ve değerlendirilmesi [Design, implementation and evaluation of fifth grade science course units with an integrated STEM education approach]* [Doctoral dissertation]. Pamukkale University.

Fensham, P. J. (2009). Real world contexts in Pisa science: implications for context based science education. *Journal of Research in Science Teaching, 46*(8), 884- 896.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education.* New York: McGraw-Hill.

Gilbert, J. K. (2006). On the nature of "context" in chemical education. *International Journal of Science Education, 28*(9), 957-976.

Gitari, W. (2016). The application of school science by urban high school youth through problem-solving in everyday life. *Science Education International, 27*(3), 344-368.

Green, M. J., & Myers, K. R. (2010). Graphic medicine: use of comics in medical education and patient care. *The BMJ, 340*(863). http://dx.doi.org/10.1136/bmj.c863.

Groensteen, T. (2007). *The system of comics.* Jackson, MS: University Press of Mississippi.

Gülen, G., & Bozdoğan, A. E. (2021). Fen bilimleri öğretmenlerinin derslerinde okul bahçelerini kullanma durumlarının incelenmesi [The evaluation of the use of school gardens by science teachers in their lectures]. *Turkish Journal of Primary Education, 6*(1), 89-108.

Güven, Ç., Selvi, M., & Benzer, S. (2018). 7E öğrenme modeli merkezli STEM etkinliğine dayalı öğretim uygulamalarının akademik başarıya etkisi [Teaching applications' based on 7e learning model centered stem activity effect on academic

achievement]. *Journal of Social Sciences of Mus Alparslan University, 6*(STEMES'18), 73-80.

Hacıoğlu, Y. (2020). Tematik STEM eğitimi uygulaması: Sürtünme kuvveti örneği [Implementation of Thematic STEM Education: Friction Force Example]. *Bogazici University Journal of Education, 37*, 3-21.

Haugen, D. M. (2005). *Comic books: Examining pop culture.* Farmington Hills. MI: Thomson Gale.

Hırça, N. (2012). Bağlam temelli öğrenme yaklaşımına uygun etkinliklerin öğrencilerin fizik konularını anlamasına ve fizik dersine karşı tutumuna etkisi [The effects of hands on activities depend on context-based learning approach on understanding of physics and attitudes]. *Mustafa Kemal University Journal of Social Sciences Institute, 9*(17), 313-325.

Hosler, J., & Boomer, K. B. (2011). Are comic books an effective way to engage non majors in learning and appreciating science? *CBE—Life Sciences Education, 10*(3), 309-317. https://doi.org/10.1187/cbe.10-07-0090.

Hoşgören, G. (2018). *Bağlam temelli kavram karikatürlerinin asit-baz konusunun öğretiminde etkililiğinin incelenmesi [An investigation of effectiveness of context based concept cartoons in teaching acid-base subject]* [Master's thesis]. Kilis 7 Aralık University.

Hutchinson, K. H. (1949). An experiment in the use of comics as instructional material. *The Journal of Educational Sociology, 23*(4), 236-245.

Ishimoto, M. (2010). Preconceptions of Japanese students surveyed using the force and motion conceptual evaluation. In *International Conference on Physics Education*, 147–50. 1263 vols. American Institute of Physics.

İlhan, G. O. (2016). *Sosyal bilgiler öğretiminde çizgi romanların kullanımı [Use of comics in social studies teaching]* [Doctoral dissertation]. Afyon Kocatepe University.

James B. Hunt, Jr. Institute for Educational Leadership and Policy. (2007). *K-8 science education: Elements that matter: A Report from the 2007 North Carolina science summit.*

Kara, F. (2016). *5. sınıf "Maddenin Değişimi" ünitesinde kullanılan bağlam temelli öğrenmenin öğrencilerin bilgilerini günlük yaşamla ilişkilendirme düzeyleri, akademik başarıları ve fene yönelik tutumlarına etkisi [The effect of context based learning used in 5th grade 'change of substance' unit on the students' levels of association the knowledge with daily life, academic achievements and attitudes towards science lesson]* [Doctoral dissertation]. Ondokuz Mayıs University.

Karslı, F., & Yiğit, M. (2017). Effectiveness of the REACT strategy on 12th grade students' understanding of the alkenes concept. *Research in Science & Technological Education, 35*(3), 274-291.

Kılıç, A., & Seven, S. (2007). *Konu alanı ders kitabı incelmesi.* Ankara: Pegem A Yayıncılık.

Kırıcı, M. G., Artun, H., & Bakırcı, H. (2018). Eğitim bilişim ağı destekli eğitimin kuvvetin ölçülmesi ve sürtünme kavramlarının öğrenilmesine etkisi [Influence of education information network aided with on teaching the concepts of "measurement of force and friction"]. *Turkish Studies, 13*(6), 23-38.

Kireççi, Ü. (2008). *Çizgi roman senaryosu önce yazı sonra çizgi.* İstanbul: Crea.

Kistak, Ö. (2014). *İlköğretim 8. sınıf fen ve teknoloji dersi ses ünitesinin yaşam temelli yaklaşımla öğretimi [Teaching the 'sound' unit with context-based learning at eight grades in science and technology lesson]* [Master's thesis]. Balıkesir University.

Kurnaz, M. A., & Çalık, M. (2008). Using different conceptual change methods embedded within 5e model: a sample teaching for heat and temperature. *Journal of Physics Teacher Education Online, 5*(1), 3-10.

Kurnaz, M. A., & Ekşi, C. (2015). An analysis of high school students' mental models of solid friction in physics. *Educational Sciences: Theory and Practice, 15*(3), 787-795.

Kurt, S. (2019). *Sosyal bilgiler öğretiminde çizgi roman kullanımına ilişkin sosyal bilgiler öğretmen adaylarının görüşlerinin incelenmesi [Examining the opinions of social studies teacher candidates on the use of comics in teaching social studies]* [Master's thesis]. İstanbul University.

Külekci, E. (2019). *Kavram karikatürü destekli probleme dayalı fen, teknoloji, mühendislik ve matematik (FeTeMM) etkinliklerinin beşinci sınıf fen bilimleri öğretimi üzerindeki etkileri [Effects of concept cartoon assisted problem based science, technology, engineering and mathematics (stem) activities on 5th grade science teaching]* [Master's thesis]. Manisa Celal Bayar University.

Lay, Y. F., Khoo, C. H., Treagust, D. F., & Chandrasegaran, A. L. (2013). Assessing secondary school students' understanding of the relevance of energy in their daily lives. *International Journal of Environmental and Science Education, 8*(1), 199-215.

Lazzarich, M. (2013). Comic strip humour and empathy as methodological instruments in teaching. *Croatian Journal of Education, 15*(1), 153-190.

Lin, S.-F., Lin, H., Lee, L., & Yore, D. L. (2015). Are science comics a good medium for science communication? The case for public learning of nanotechnology. *International Journal of Science Education, 5*(3), 276–294.

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation.* New Jersey: John Wiley & Sons.

Metcalf, S. J. & Tinker, R.F. (2004). Probeware and handhelds in elementary and middle school science. *Journal of Science Education and Technology, 13*(1), 43-49.

MoNE. (2018). *Fen bilimleri dersi öğretim programı (İlkokul ve Ortaokul 3, 4, 5, 6, 7 ve 8. Sınıflar) [Elementary science lesson (primary and secondary school 3-8th grades) curriculum].* Ankara: Millî Eğitim Bakanlığı Temel Eğitim Genel Müdürlüğü.

Mustafaoğlu, F. M. (2019). *Kimya öğretmenlerinin bağlam temelli etkinlik hazırlama ve uygulama becerilerinin geliştirilmesi [Developing chemistry teachers skills for designing and implementing context based activities]* [Doctoral dissertation]. Hacettepe University.

Mutlu, Z. (2019). *Sosyal bilgiler öğretmen adaylarının sosyal bilgiler öğretiminde çizgi roman kullanımına yönelik görüşleri [The opinions of the social studies teacher candidates on using comics during the process of teaching social studies]* [Master's thesis]. Mugla Sıtkı Kocman University.

Olson, J. C. (2008). *The comic strip as a medium for promoting science literacy* [Master's thesis]. California State University.

Orçan, A. (2013). *Çizgi-roman tekniği ile geliştirilen bilim-kurgu hikâyelerinin öğrencilerin yaratıcı düşünme becerilerinin ve fiziğe ilişkin tutumlarının gelişimine*

etkisi [The effect of science-fiction stories developed by comics technique, on creative thinking skills and physics attitudes of students] [Master's thesis]. Gazi University.

Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice.* Thousand Oaks, California: SAGE Publications.

Pilot, A., & Bulte, A. M. W. (2006). The use of "contexts" as a challenge for the chemistry curriculum: Its successes and the need for further development and understanding. *International Journal of Science Education, 28*(9), 1087- 1112.

Rose, D. E. (2012). Context-based learning. In N. Seel (Ed.), *Encyclopedia of the sciences of learning* (pp. 799- 802). Springer.

Rota, G., & Izquierdo, J. (2003). "Comics" as a tool for teaching biotechnology in primary schools. *Issues in Biotechnology Teaching, 6*(2), 85-89.

Sarıbıyık, M. S. (2018). *İlkokullarda milli tarih şuurunu kazandırmada tarihi çizgi romanların önemi: Tarkan çizgi romanları örneği [The importance of historical graphic novels to cause the students to gain national conscience in elementary schools: The sample of Tarkan graphic novels]* [Master's thesis]. Giresun University.

Sari, Ö. (2010). *İlköğretim 5. sınıf öğrencilerine dünya ve evren öğrenme alanında bağlama dayalı yaklaşımın benimsendiği bir materyalin geliştirilmesi [Developing a material based on the context based approach on the topic 'the earth and the universe' for the 5th grade primary students]* [Master's thesis]. Gazi University.

Schiefele, U., Schaffner, E., Möller, J., & Wigfield, A. (2012). Dimensions of reading motivation and their relation to reading behavior and competence. *Reading Research Quarterly, 47*(4), 427-463.

Schwartz, A. T. (2006). Contextualised chemistry education: The American experience. *International Journal of Science Education, 28*(9), 977-998.

Siverton, M. L. (1993). *Transforming ideas for teaching and learning science.* Washington, DC: US Department of Education.

Slavin, R. E., Lake, C., Hanley, P., & Thurston, A. (2014). Experimental evaluations of elementary science programs: A best-evidence synthesis. *Journal of Research in Science Teaching, 51*(7), 870-901.

Solvang, L., & Haglund, J. (2021). Learning with friction—students' gestures and enactment in relation to a GeoGebra simulation. *Research in Science Education*, 1-17.

Sözbilir, M., Sadi, S., Kutu, H., & Yıldırım, A. (2007). Kimya eğitiminde içeriğe/bağlama dayalı (context-based) öğretim yaklaşımı ve dünyadaki uygulamaları. *I. Ulusal Kimya Eğitimi Kongresi*, s. 108.

Spiegel, A. N., McQuillan, J., Halpin, P., Matuk, C., & Diamond, J. (2013). Engaging teenagers with science through comics. *Research in Science Education, 43*(6), 2309-2326.

Taşkın, T., & Moğol, S. (2017). Fizik eğitiminde yaratıcı drama yöntemine bir örnek: sürtünme kuvveti [An example for creative drama in physics education: friction force] *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 11*(1), 198-221.

Tatalovic, M. (2009). Science comics as tools for science education and communication: a brief, exploratory study. *Journal of Science Communication, 8*(4), 1-17.

Tavukçuoğlu, E. (2018). *Lise öğrencilerinin sürtünme kuvveti, ivme ve eylemsizlik kavramlarıyla ilgili bilişsel yapılarının araştırılması [Investigating high school students' cognitive structures about friction, acceleration and inertia concepts]* [Master's thesis]. Hacettepe University.

Tekbıyık, A. (2010). *Bağlam temelli yaklaşımla ortaöğretim 9. sınıf enerji ünitesine yönelik 5E modeline uygun ders materyallerinin geliştirilmesi [Development of course materials integrating context based approach into 5E model in terms of energy unit for 9th grade secondary students]* [Doctoral dissertation]. Karadeniz Teknik University.

Topkaya, Y. (2014). *Vatandaşlık ve demokrasi eğitimi dersinde eğitici çizgi roman kullanımının bilişsel ve duyuşsal öğrenmelere etkisi* [*Impact of usage of comics on cognitive and emotional learning in citizenship and democracy education classes]* [Doctoral dissertation]. Atatürk University.

Topkaya, Y., & Şimşek, U. (2016). The effect of educational comics on the academic achievement and attitude towards earthquake. *International Online Journal of Educational Sciences, 8*(3), 46-54.

Tulum, G. (2019). *Fen bilimleri dersi ışık konusuna yönelik geliştirilen bağlam temelli materyalin akademik başarı üzerine etkisi [The effect of context-based material on academic achievement in light science course]* [Master's thesis]. Ondokuz Mayıs University.

Tuncer, N. (1993). *Çizgi roman ve çocuk.* İstanbul: Çocuk Vakfı.

Ültay, E. (2012). Implementing REACT strategy in a context-based physics class: Impulse and momentum example. *Energy Education Science and Technology Part B: Social and Educational Studies, 4*(1), 233-240.

Ültay, E., & Ültay, N. (2012). Designing, implementing and evaluating a context-based instructional materials on buoyancy force. *Energy Education Science and Technology Part B: Social and Educational Studies, 4*, 201-205.

Ültay, E. (2014). *İtme, momentum ve çarpışmalar konusuyla ilgili bağlam temelli öğrenme yaklaşımına dayalı açıklama destekli REACT stratejisine göre geliştirilen etkinliklerin etkisinin araştırılması [Investigating the effect of the activities based on explanation assisted REACT strategy in context-based learning approach on impulse, momentum and collisions]* [Doctoral dissertation]. Karadeniz Teknik University.

Ültay, N. (2015). The effect of concept cartoons embedded within context-based chemistry: Chemical Bonding. *Journal of Baltic Science Education, 14*(1), 96–108.

Ünal, O. (2018). *Sosyal bilgiler dersinde eğitici çizgi roman kullanımının öğrenci başarısı ve tutumuna etkisi [The effect of using educational comics in social studies course on students' success and attitudes]* [Master's thesis]. Akdeniz University.

Ünal, O., & Demirkaya, H. (2019). A semi-experimental study on the use of educational comics in social studies. *International Journal of Geography and Geography Education* (IGGE), *40*, 92-108.

Vos, M. A. J., Taconis, R., Jochems, W. M. G., & Pilot, A. (2011). Classroom implementation of context-based chemistry education by teachers: The relation

between experiences of teachers and the design of materials. *International Journal of Science Education, 33*(10), 1407-1432.

Whitelegg, E., & Parry, M. (1999). Real-life contexts for learning physics: meanings, issues and practice. *Physics Education 34*(2), 68–72.

Wood, M. (2015). *The effect of graphic novel supplements on reading comprehension and motivation in secondary students* [Doctoral dissertation]. University of Central Arkansas.

Yıldırım, E. (2016). Sınıf öğretmeni adaylarının eğitici çizgi roman hakkındaki görüşlerinin incelenmesi [Examining opinions of classroom teacher candidates on educational comics]. *Kilis 7 Aralık Üniversitesi Sosyal Bilimler Dergisi, 6*(11), 52-70.

Yüzbaşıoğlu, M. K. (2022). *"Kuvvetin ölçülmesi ve sürtünme" ünitesine yönelik bağlam temelli tasarlanan çizgi romanların öğrencilerin temellendirilmiş zihinsel model gelişimine etkisi [The effect of context based comics for the 'measurement of force, and friction' unit on the development of students' grounded mental model]* [Doctoral dissertation]. Kastamonu University.

Yüzbaşıoğlu, M. K., & Kurnaz, M. A. (2022a). Fen eğitiminde çizgi roman. In H. Bozdemir Yüzbaşıoğlu & E. Ezberci Çevik (Eds.), *Güncel gelişmeler odağında fen öğretimi* (pp.327-347). Ankara: Pegem Akademi.

Yüzbaşıoğlu, M. K., & Kurnaz, M. A. (2022b). Ortaokul öğrencilerinin kuvvetin ölçülmesi ve sürtünme ünitesine yönelik alternatif fikirlerinin incelenmesi: Skor analizi [*Investigation of secondary school students' alternative ideas for "measuring of force and friction" Unit: Score analysis]*. *Mehmet Akif Ersoy University Journal of Education Faculty, 61*, 1-22.

Appendix

Appendix-1 Comic Book Student Interview Form

1- Have you read comic books before? If yes, will you please mention the comics you've read?

2- What do you think about the use of a comic book in science class?

3- Do you think other units in the science course can be taught with a comic book?

4- How did you feel when learning the subject with a comic book?

5- What did you think when learning the subject with a comic book?

6- Did you have fun when learning the subject with the comic book?

a- Can you mention the entertaining parts?

7- Were you bored when learning the subject with the comic book?

b- Can you mention any boring parts?

8- Which other courses do you think comic books can be used?

9- Did the comic book help you associate the information you learned at school with everyday life?

10- Which parts of this comic book would you change, if you were given the opportunity to do so?

Appendix-2 Comic Book Teacher Interview Form

1- Have you read comic books before? If yes, will you please mention the comics you've read?

2- Can you please tell us about your opinions about teaching with comic book?

a- What were your thoughts about the use of a comic book before the implementation?

b- What were your thoughts about the use of a comic book after the implementation?

c- Did you have any challenges while teaching with the comic book?

d- Did the comic book facilitated your teaching?

3- What kind of reactions did you get from the students in general when you were teaching with the comic books?

a- In which parts did you receive positive feedback?

b- In which parts did you receive negative feedback?

4- Can you tell us about your other course designs? What are the main differences between teaching with a comic book?

5- How did teaching with a comic book affect your lessons?

6- Do you think comic books can be used while teaching other units of the science course?