

# Content Analysis of Biology Education Research That Used Context-Based Approaches: The Case of Turkey

Burcu Gngr Cabbar (Corresponding author)

Necatibey Faculty of Education, Balikesir University

10100, Altieyll, Balikesir, Turkey

Tel: 00-90-505-8966236 E-mail: burcu.cabbar@balikesir.edu.tr

Hakan Őenel

Institde of Science and Technology, Balikesir University

aęıŐ, Balikesir, Turkey

Tel: 00-90-544-7857969 E-mail: hakanindoktoratezi@gmail.com

Received: April 26, 2020 Accepted: May 27, 2020 Published: June 2, 2020

doi:10.5296/jei.v6i1.16920 URL: <https://doi.org/10.5296/jei.v6i1.16920>

## Abstract

Even if the topics are abstract in biology education, they are very suitable for association to daily life. The context-based learning approach is one of the approaches that is student-centered and provides a connection between daily life and scientific knowledge. Research has determined that the context-based learning approach increases the students' learning about the subject, their interest, and motivation by using examples from daily life. In Turkey, the context-based approach first began to be used in chemistry education. This approach was first applied in biology education in 2008. Nineteen theses and articles completed regarding the context-based approach in biology education in Turkey were encountered when researched. All of these studies were done by using experimental methods. It was determined in research conducted with students of different age groups that context-based learning has a positive effect on motivation as well as on academic success. The effect of the method can be investigated by studying different subjects within biology and with different sample groups.

**Keywords:** Context-based learning approach, Biology education, Content analysis

## 1. Introduction

Teaching in recent years had faced many problems such as the high amount of information to be taught, the lack of relationships between information, and information pollution caused by the ease in terms of acquisition of information and not giving sufficient importance to the information. The effort to overcome these problems has led to the development of various teaching approaches that enable the structuring of knowledge by centering the student. The context-based learning approach is one of them.

Two of the main objectives of science education are to ensure that students are scientifically literate and to develop their high-level cognitive processing skills. Real-life contexts are important for scientific literacy. Learning that is established around a context and established within daily life is more permanent (Avargil, Herscovitz, & Dori, 2012). Science subjects are very suitable for explanation in relation to real-life problems and for understanding with the help of these contexts. If science education occurs in this way, scientific literacy, scientific processing skills and 21st-century skills will also increase (Gilbert, 2006).

Science, including biology, usually contains abstract and complex topics. It is easy to understand when it is embodied through examples and daily life (Üstün, Yıldırğan, & Çeğiç, 2001). Since the subjects that are not related to daily life are out of context, they are generally studied by students until the exam and then forgotten. Today, theories developed using the experience gained in the teaching process and their practical applications have been integrated into the teaching process. One of these applications is context-based learning with a constructivist learning approach (Acar & Yaman, 2011).

Education is a multi-stakeholder activity. In the triangle of students, teachers, and knowledge, many auxiliary materials, techniques, and methods are important for the permanence of learning. Strong interaction between students and teachers ensures that the learning environment is healthy. The fact that this point of interaction is connected with life is important for permanence and easy understanding of the information. One of the biggest obstacles in the educational process is the lack of motivation of the student and/or teacher during the learning process. One approach developed to remove this barrier is the context-based approach (Bülbul & Matthews, 2012).

Contexts are useful when used as a starting point for science teaching, as they improve attitudes towards science even though students might have different levels of interest and motivation towards the context (Tolppanen et al., 2019; King & Henderson, 2018; Bennet, Lubben, & Hogarth, 2007). The context-based learning approach enables students to explore scientific concepts through daily life contexts. Thus, it increases students' motivation to learn science, and permanence of knowledge (Barker & Millar, 1999; Özay-Köse & Çam-Tosun, 2011, Gilbert, Bulte & Pilot, 2011; Herranen et al., 2019; Jeffery, Cass, & Sweeder, 2019).

The context-based teaching model was first introduced as 'Salters Chemistry' (Salters) by a group of researchers working in the field of chemistry education at York University in England in the early 1980s. Afterward, 'Chemistry in Community (ChemCam)' and 'Chemistry in Context (CIC)' in the USA, 'Chemie im Kontext (Chik)' in Germany,

‘Industrial Chemistry (IC)’ in Israel and in the Netherlands. He was involved in improving the curricula of many countries with different names such as Chemistry in Practice (ChiP) (Bennett & Lubben, 2006; Pilot & Bulte, 2006). In Turkey, under the leadership of Sözbilir in 2007, it began to be used in chemical education. It was observed that studies about this subject in biology education have been carried out since 2008.

Context-based teaching has three main elements. These are context, basic knowledge, and method. In teaching, context helps to examine the situation of the subject and to present it from different aspects and relationships. Thus, the subject will not be abstract for students and the relations between daily life and the subject will emerge. The aim is not just to reveal different aspects of the subject. It is also important to determine the basic field knowledge, that is, basic concept information, principles, and generalization frameworks. When basic information is presented in different situations, examples, and relationships with the help of contexts, students are assisted in learning from a broader and connected context. Also, designing a teaching environment in this way is seen as a stimulating factor for students to think about new questions, problems, and phenomena, to work on them, and to develop solution strategies. With the context-based learning approach, many types of research were completed to investigate the effect on students of variables such as student success, attitude, interest, motivation, and problem-solving skills (Acar & Yaman, 2011; Choi & Johnson, 2005; Çetin, 2014; Heller & Hollabaugh, 1992; Holman & Pilling, 2004; Kesner, Hofstein, & Ben-Zvi, 1997; Kutu & Sözbilir, 2011).

When the studies are examined, no teaching method is emphasized in context-based learning. The availability of different methods gives flexibility to the approach and enables it to be used with different strategies.

Topics such as genetics, cell structure, microorganisms, and living chemistry in biology education are abstract topics. Some issues, such as anatomical structures and the environment, are concrete. Associating the topics of biology, defined as life science, with daily life will increase the permanence of information. Context-based learning is one of the recommended methods for use in biology education with this aspect. This research aims to examine research that use the context-based learning in biology education.

Research in different branches in the literature also support the context-based research findings in biology education. For example, Demircioğlu (2008) determined that both success and attitude increased positively as a result of the research he conducted on elementary teacher candidates about the states of matter. In his study in 1995, Rioseco taught physics courses in Chile for 3 years using a context-based approach. In his study, which he compared with lessons taught using traditional methods, he found that there was a positive increase in students’ achievements.

### *1.1 Purpose of the Study*

This study aims to investigate the biology education studies which use a context-based learning approach in Turkey. For this purpose, answers were sought to the following sub-problems:

- (1) What are the objectives of biology education studies involving the use of a context-based learning approach in Turkey?
- (2) What are the methods used by the biology studies involving the use of a context-based learning approach in Turkey?
- (3) What are the data collection methods in biology education studies using a context-based learning approach in Turkey?
- (4) What are the signs and context-based approach to learning in the results of studies about biology education in Turkey?

### *1.2 Importance of the Research*

Research shows that since 2008, the context-based approach has been used in biology education in Turkey. This research examined these studies and content analysis revealed the results in tables. With the context-based learning approach, it is predicted that it will support literature studies by presenting the data to the researchers who want to study from now on. It is also thought that it will be a guide for new studies stated in the research recommendations.

## **2. Method**

The researchers used the keywords “context-based learning”, “life-based learning” to search for the articles and theses that researched context-based learning in biology education in Turkey. The theses in this research were accessed from the database of the “National Thesis Center”. For articles, ULAKBİM and Google Scholar databases were used.

Nineteen studies matching the criteria were reached. These studies were analyzed descriptively according to the categories created in the sub-problems. The research is limited to theses and articles open to access as of October 2019. Apart from the theses and scientific articles, book chapters, oral, poster presentations, etc. presented in congresses were not included in the research. Since biology education focuses on context-based approach research, context-based research conducted in different disciplines is also not covered in this research.

## **3. Findings**

The findings are presented in four sections in line with the sub-problems of the study. The first part includes the objectives of the studies, the second part includes the research method used in the studies, the third part includes the data collection tools and sampling method, and finally, the fourth part is about the results of the research.

### *3.1 Aims of Biology Education Studies Using Context-Based Learning Approach*

Context-based biology studies are grouped in 12 categories according to the purposes in Table 1.

Table 1. Aims of biology education studies using a context-based learning approach

	Aims	Researches	<i>f</i>
1	Effect on academic success	Çam, 2008; Özyay Köse & Çam Tosun, 2011; Özyay Köse & Çam Tosun, 2013; Akdaş, 2014; Özyay Köse & Çam Tosun, 2015; İçöz, 2016; Ünal, 2016; Gül, Gürbüzöğlü Yalmanlı & Yalmanlı, 2017; Konu, 2017; Sarı Ay, 2017; Gül & Konu, 2018; Hoşbaş, 2018	12
2	Effect on attitude	Çam, 2008; Akdaş, 2014; Özyay Köse & Çam Tosun, 2015; Gül, 2016; Konu, 2017; Konu & Gül, 2017	6
3	Effect on motivation	Gül, 2016; Gül, Gürbüzöğlü Yalmanlı & Yalmanlı, 2017; Konu, 2017; Konu & Gül, 2017	4
4	Effect on attitude to the environment	Gürsoy Köroğlü, 2011; İçöz, 2016; Ünal, 2016	3
5	Effect of information on permanence	Akdaş, 2014; Gül, 2016; Sarı Ay, 2017.	3
6	Effect on cognitive processing skills	Çam, 2008; Özyay Köse & Çam Tosun, 2013; Hoşbaş, 2018	3
7	Conducting and developing the course suitable for the content-based approach	Acar & Yaman, 2011; Özyay Köse & Çam Tosun, 2011	2
8	Effect on environmental interest	Gürsoy Köroğlü, 2011; Sarı Ay, 2017.	2
9	Effect on interrogative learning skills	Gül, 2016; Gül, Gürbüzöğlü Yalmanlı, & Yalmanlı, 2017	2
10	Effect on problem-solving skills	Konu, 2017; Konu & Gül, 2017	2
11	Effect on understanding the nature of science	Duruk, 2017; Hoşbaş, 2018	2
12	Effect on conceptual learning and alternative concepts	Karslı & Saka, 2017	1

As seen in Table 1, in 12 of the 19 studies examined the aim was to examine the effect of context-based learning on academic achievement. As seen from the table, some studies targeted more than one goal and examined the effect of contextual learning in 12 categories. In addition to the studies investigating the effect of context-based learning on attitude and motivation towards the course, the effects of learning processes and permanence were also examined. It is observed that a study was also conducted on context-based question writing and the effect of the context-based approach in the measurement and evaluation process.

### 3.2 Method of Context-Based Biology Education Studies in Turkey

The studies examined were analyzed in terms of the method used and divided into two groups, theoretical and experimental, and are presented in Table 2. Theoretical research involved scanning, selecting, analyzing, and classifying documents and completing logical analysis within the framework of previous research. Experimental research includes research based on practice, experiment, or observation, not just a theory.

Table 2. Method of context-based biology studies

	Studies (sorted by date)	Theoretical studies	Experimental Studies
1	Çam, 2008		✓
2	Acar & Yaman, 2011		✓
3	Gürsoy Koroğlu, 2011		✓
4	Özay Köse & Çam Tosun, 2011		✓
5	Özay Köse & Çam Tosun, 2013		✓
6	Akdaş, 2014		✓
7	Özay Köse & Çam Tosun, 2015		✓
8	Gül, 2016		✓
9	İçöz, 2016		✓
10	Ünal, 2016		✓
11	Duruk, 2017		✓
12	Gül, Gürbüzöğlü Yalmançı, & Yalmançı, 2017		✓
13	Karsli & Saka, 2017		✓
14	Konu, 2017		✓
15	Konu & Gül, 2017		✓
16	Sarı Ay, 2017		✓
17	Yeşilyurt, 2017		✓
18	Gül & Konu, 2018		✓
19	Hoşbaş, 2018		✓

In Table 2, all 19 studies related to the context-based approach in biology education were experimental studies. When looking at studies in field education, it is possible to say that experimental study is dominant. The designs of the studies were experimental or

quasi-experimental designs and mixed methods were preferred.

In Table 2, the 4<sup>th</sup>, 5<sup>th</sup> and 7<sup>th</sup> studies were by Özey Köse et al. The 8<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> studies about the subject were by Gül. There are studies performed by the same researchers for different purposes and different groups. Researchers focusing on this subject have completed their research with experimental studies.

### *3.3 Data Collection Tools of Biology Education Studies Using a Context-Based Learning Approach*

The data collection methods of 19 studies related to biology education using a context-based learning approach and information about how the sample was chosen are presented in Table 3.

Table 3. Data collection tools and sampling types of context-based biology education studies

Studies (sorted by date)		Data Collection Tools						Sample				
		Interview	Observation	Portfolio	Paper surveys			Sample size and group	Sampling Type			
					Open-ended	Survey			Oriented	Random	Volunteer	Not defined
						Likert type	Multichoice					
1	Çam, 2008	✓			✓	✓	✓	94 (teacher candidates)		✓		
2	Acar & Yaman, 2011					✓	✓	191 (9th class students)		✓		
3	Gürsoy Koroğlu, 2011	✓			✓	✓		30 (teacher candidates)				✓
4	Özay Köse & Çam Tosun, 2011				✓		✓	37 (teacher candidates)	✓			
5	Özay Köse & Çam Tosun, 2013					✓	✓	94 (teacher candidates)		✓		
6	Akdaş, 2014					✓	✓	43 (7th class students)	✓			
7	Özay Köse & Çam Tosun, 2015	✓				✓	✓	94 (teacher candidates)		✓		
8	Gül, 2016	✓				✓	✓	52 (11th class student)	✓			
9	İçöz, 2016				✓	✓	✓	113 (10th class student)	✓			
10	Ünal, 2016				✓	✓	✓	67 (9th class students)	✓			
11	Duruk, 2017							65 (teacher candidate)				
12	Gül, Gürbüzöglü Yalmanç, & Yalmanç, 2017					✓	✓	58 (10th class student)			✓	
13	Karsli & Saka, 2017	✓			✓		✓	40 (5th class student)		✓		
14	Konu, 2017	✓				✓	✓	106 (11th class student)		✓		
15	Konu & Gül, 2017					✓		106 (11th class student)		✓		
16	Sarı Ay, 2017							60 (5th class student)	✓			
17	Yeşilyurt, 2017						✓	21 (5th class student)				✓
18	Gül & Konu, 2018	✓					✓	106 (11th class student)		✓		
19	Hoşbaş, 2018					✓	✓	50 (7th class student)				✓



When Table 3 is examined, no study was found to collect data with the help of a portfolio. The sampling method of 1 research was not mentioned. While only 1 study used a voluntary sampling method, 6 studies were carried out and 8 studies were carried out with a random sampling method. Likert or multiple-choice questionnaire were used in all studies except for one study.

### *3.4 Findings and Results of Biology Education Studies Using Context-Based Learning Approach*

Table 4 contains summaries of the findings and results of the studies.

Table 4. Findings and Results of Biology Education Studies Using Context-Based Learning Approach

Research		Findings and results
1	Çam, 2008	When the context-based learning approach is used, it was found to cause more success than traditional teaching method.
2	Acar & Yaman, 2011	The courses designed and applied with the context-based learning approach positively affected the students' understanding of the subject of "microorganisms". The context-based learning approach is important in terms of stimulating students' interests and wishes. It affects success positively as it includes activities aimed at developing biological ideas.
3	Gürsoy Koroğlu, 2011	Conscious consumer behaviors of biology teacher candidates changed with the "Context-Based Learning Approach Prepared for Biodiversity and Nature Conservation". Influencing behavior shows that a very high level of cognitive behavior occurs. Their interest in the environment and their attitudes towards biodiversity and nature protection increased positively when the pretest-posttest scores are compared.
4	Özay Köse & Çam Tosun, 2011	There was a significant difference in students' academic achievements after applying a context-based learning approach. Although it was not observed to affect academic success sufficiently in every subject, this research supports the studies with findings that it affects academic success positively.
5	Özay Köse & Çam Tosun, 2013	A significant difference was determined in terms of the success and scientific processing skills of education designed with the context-based learning approach compared to groups in which traditional education was conducted. Activities designed with the context-based learning approach increased the success and scientific processing skills positively.
6	Akdaş, 2014	One of the approaches that positively affects students' academic achievements towards environmental thinking, behavior, and subject are activities based on the context-based learning model. This research, which was determined to have a positive effect on the permanence levels of information, is one of many studies that determine the positive effect of the context-based learning approach on permanence.
7	Özay Köse &	As a result of the application based on context-based learning, it was shown that there is

	Çam Tosun, 2015	a significant difference in terms of students' achievements and attitudes compared to the traditional method. The results of interviews also supported these findings.
8	Gül, 2016	The method used did not have a statistically significant effect on students' attitudes, motivation, and questioning learning skills perceptions. However, it revealed that learning provides permanence.
9	İçöz, 2016	The results showed that context-based education has a positive effect on students' academic success and attitudes towards the environment compared to traditional education. The interactions of the method and school type used are statistically significant on students' attitudes towards the environment; however, it is not statistically significant on students' success. When comparing school type scores, no statistically significant difference was found between different school types.
10	Ünal, 2016	In the teaching of environmental issues in a biology lesson, case study, and research inquiry-based science learning methods regarding a context-based approach were applied for the context-based approach. When the results are analyzed, the methods used increased academic success about environmental issues and that students developed attitudes towards environmental problems and increased their attitudes.
11	Duruk, 2017	When the findings related to quantitative and qualitative data were analyzed together, the participants in the experimental group showed more significant development in terms of quantitative findings and qualitative findings in terms of producing scientific knowledge in a socio-cultural environment. Therefore, it was concluded that the nature of the context-based science based on metacognitive strategies was effective in developing an understanding of this component, but it provided low persistence at rates similar to that of context-based teaching applied in the control group in terms of permanence.
12	Gül, Gürbüzöglü Yalmanç & Yalmanç, 2017	The relationship between context-based learning and perceptive learning skill perception was examined. When students' Questioning Learning Skills Perception Scale was examined, the post-test scores obtained from the scale did not show a statistically significant difference. Although this is thought-provoking when the average difference between the scale scores before and after the application is examined, it is understood that there was an increase in the scores of both groups and this increase is much more in the experimental group.
13	Karsli & Saka, 2017	The subject of 'Let's Know Foods' was covered in the learning environment designed according to the REACT strategy from the Context-Based Approach. The data obtained at the end of the application were found to have a positive effect on students' conceptual understanding. Also, it was concluded that the learning environment designed according to the REACT strategy is more effective than the learning environment designed according to the 5E teaching model in terms of students' conceptual changes.
14	Konu, 2017	Success tests of the digestive and circulatory systems were applied in the study. When the findings of the digestive system test were examined, there was no significant difference between the experimental and control group posttest success scores. However, when the findings of the circulatory system success test were examined, a statistically significant increase was found in favor of the experimental group. This shows that the method has different effects in different subjects. It was determined that the students'

		attitude, motivation, and problem-solving skills were at a high level before and after the application and there was no statistically significant difference between the groups. Semi-structured interviews were held with students. At the end of the interviews, it was determined that the method has some disadvantages for some subjects. According to the interviews, the students stated mostly positive opinions about context-based problem-based learning practices.
15	Konu & Gül, 2017	No statistically significant difference was found between the averages of the pre-test and post-test scores obtained from the Students' Biology Course Attitude Scale. When the findings of the students' scores obtained from the Biology Lesson Motivation Questionnaire were examined, the pretest scores of both groups were "high" before the application and a higher increase was observed in favor of the experimental group after the application. It was revealed that there was no statistically significant difference between the mean scores obtained from the Problem Solving Inventory applied to the students as pre-test and post-test.
16	Sarı Ay, 2017	The students expressed a positive opinion about their learning environment. The results showed that the method used increased student success and environmental awareness, and ensured the permanence of information.
17	Yeşilyurt, 2017	In the study, applications suitable for the contextual approach for nutrition awareness were designed for students. Looking at the findings, applications contributed to students' awareness of nutrition.
18	Gül & Konu, 2018	A successful test was applied after the application. The findings of the Digestive System Success Test revealed that there was no statistically significant difference between the groups in terms of the students' post-test scores. When the findings of the Circulatory System Success Test were examined, there was a statistically significant increase between the groups in favor of the experimental group. Semi-structured interview data show that although students mention some disadvantages regarding the method, they report very positive opinions.
19	Hoşbaş, 2018	It was determined that the context-based learning approach significantly increased the academic success of the students in the experimental group, and when their opinions about the nature of science were examined, there was a significant difference between the posttest and retention test. It was determined that there was no effect on the scientific process skills since the posttest and permanence test scores were close to each other, and the achievement scores and scientific process skills did not differ according to gender. When only opinions about the nature of science are analyzed, it is concluded that male students had higher values than female students.

Looking at Table 4, 19 studies can be seen. When we look at the authors of these studies, the same researchers are working on this subject alone and with different scientists. They researched the subject in depth with different dimensions and different samples. When the findings of the research are analyzed, the applications made with the context-based learning approach generally affect academic success, attitude, and motivation positively. Konu and

Gül (2017) stated that the findings of the research included disadvantages about the method and that the same success was not seen in every subject.

In all of the context-based research about environmental issues, some findings positively affect success and attitude. Regarding persistence, some of the research included positive findings and some had no differences.

#### **4. Discussion**

In line with the findings obtained in the research, the subjects of biology lessons are related to daily life and can easily be designed with methods appropriate to the context-based approach. Studies conducted by Gül (2016), Gül, Gürbüzöğlü Yalmanç, and Yalmanç (2017), Konu (2017), and Konu and Gül (2017) reveal that the context-based approach is a method that can increase students' interest and motivation towards the course.

The increase in interest and motivation naturally increases academic success.

The context-based learning approach enables students to make connections between the situations encountered in their daily lives and the subject. It does not contain contextual events and real-life situations and allows students to learn by building a context with their life experience. Thanks to the activities created based on context-based learning, the information gained in the lessons is more easily remembered. This situation increases the permanence of the information (Akdaş, 2014; Gül, 2016; Sarı Ay, 2017; Williams, 2019). Even if it does not have the same effect in every subject, its positive effect on motivation accelerates the process of obtaining information.

For this reason, it may be suggested to apply these applications to different biology subjects or subjects belonging to other courses.

Additionally, Karşlı and Yiğit (2015) investigated the effect of the context-based approach on conceptual understanding in their study and determined that they overcame the misconceptions about alkanes better than traditional methods. In biology education, conducting research to determine the effect of context-based learning on conceptual understanding will contribute to the field.

If the learner can make sense of the knowledge, learning at the conceptual level takes place. This information is transferred to other situations and used for the solution to problems, indicating that the learner has higher-level skills in cognitive processing skills. According to the context-based learning approach, the student can use any environment they are in to achieve conceptual learning. The learning environment should be prepared in line with the interests and abilities of the students. Many different social, cultural, and physical environments in which conceptual learning can occur should be made suitable for learning. Questions and situations that will connect these environments with real-life will increase the permanence of information and motivation about the subject.

Looking at samples of the studies, most were completed with students in formal education. Studies with teachers and preservice teachers are important to determine the effect of the context-based learning approach.

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