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THE EFFECT OF REACT STRATEGY-BASED INSTRUCTION ON 11TH GRADE STUDENTS' ATTITUDES AND MOTIVATIONS[i]

Sergün Kaya[1],
Şeyda Gül[2ii]
[1]Department of Mathematics & Science Education,
Ataturk University, Erzurum,
Turkey
[2]Atatürk University,
Kâzım Karabekir Education Faculty,
Department of Mathematics & Science Education,
Biology Education Division,
Turkey
orcid.org/0000-0003-4005-2158

Abstract:
The aim of this research is to examine the effect of REACT (relating, experiencing, applying, cooperating, transferring) strategy-based instruction on 11th grade students' attitudes towards biology science and biology course and their motivation towards context-based biology. The research was used quasi-experimental method. The sample of the research consisted of 50 students attending to the 11th grade of a randomly determined public school. The 'Biology Science and Course Attitude Scale' and 'Context-Based Biology Motivation Scale' was used as data collection tools. Descriptive statistics (arithmetic mean, standard deviation etc.), independent samples t-tests and ANCOVA analysis were used in the analysis of the data. According to the findings, statistically significant differences emerged in favour of the experimental group between the pre-test and post-test scores obtained from the students' attitude and motivation scales, and these findings were interpreted as the positive effect of REACT strategy-based teaching on these variables.

Keywords: attitude; biology lecture; motivation; REACT strategy

1. Introduction

In science courses, it is aimed to raise individuals who can produce effective solutions to real life problems and are aware of the close relationship of the science concepts they

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[ii] Correspondence: email seydagul@atauni.edu.tr

have learned with the real world. However, students have generally difficulties in science lessons. Underlying the difficulties are that the lessons are generally taught with traditional teaching approaches and the students' less interest in science lesson (Bennett, Grasel, Parchmann & Waddington, 2005; Gilbert, Bulte & Pilot, 2011; Karslı & Saka, 2017; King, 2012). Based on these negativities, the education programs in our country were updated by the Ministry of National Education in 2004 and a constructivist approach was adopted.

In the constructivist approach, learning is the effectively reconstruction of the knowledge by creating meanings by the learner rather than directly teaching it (Biggs, 1996). Learners actively structure their existing knowledge and the problems they newly encounter. Considering the structure of constructivism, it is seen that it is an effective approach for students' meaningful learning. However, although the constructivist approach is highly effective in increasing the success by providing meaningful and permanent learning in science teaching, it may be too assertive to say that constructivism is an absolute method in solving all problems in this subject (Erdoğan-Karaş, 2019). Regarding this issue, in a research conducted by Işık, Budak, Baş, and Öztürk (2015) in our country, it was examined the views of the instructors at the faculties of education on teaching via the constructivist approach. According to the findings, it was concluded that the participants found the constructivist approach positive, but were limited in its implementation due to the lack of time, the structure of the subjects, the intensity of the curriculum. Similarly, Gilbert (2006) drew attention to the problems such as the overload of the curriculum, the students not knowing that the subjects will be associated with daily life, and the deficiencies in the transfer of knowledge (lack of transfer). When the studies conducted on this subject in the literature are evaluated in general, the reason for the inadequacy of this approach is that the subjects are intense, the new knowledge cannot be connected with daily life or the student has difficulty in transferring this information to daily life, and most importantly, the student cannot find a convincing answer about why this information is learned (Ültay & Çalık, 2011). Context-Based Learning (CBL) is suggested for the purpose of eliminating such problems and a more qualified education.

2. Context-based learning (CBL)

In recent years, CBL approach has taken its place in science teaching programs of many countries and has been used frequently in science teaching activities (Broman, Bernholt, & Christensson, 2020; Deveci & Karteri, 2020; Sevian, Dori, & Parchmann 2018). The ‘context’ or ‘application of science to a real-world situation’ in the context-based approach are the processes used in science teaching (King, Winner, & Ginns, 2011). Therefore, CBL emphasizes the fact that students take into account the social context in the learning environment, as well as the real context of knowledge that is crucial to the acquisition and processing of knowledge (Deveci & Karteri, 2020; Yu, Fan, & Lin 2015).

Because the CBL approach also deploys constructivist learning theory (Glynn & Koballa, 2005), the student’s pre-existing knowledge initially has a pivotal role in

knowledge-building; but the CBL exploits relevant contexts that activate student's pre-existing knowledge in learning new knowledge (Ültay & Çalik, 2016). Hence, the CBL approach creates a "need-to-know" basis to develop coherent mental maps of knowledge and to increase the relevance of the subject (Ültay & Çalık, 2012).

CBL embraces a range of innovative methods that situate student learning in realistic settings (Williams, 2008). Context-based approaches are approaches adopted in science teaching where contexts and applications of science are used as the starting point for the development of scientific ideas (Bennett, Lubben, & Hogarth, 2007). With the CBL, students are presented scientific content and also, is created a learning environment in which they need information in the presence of current events or contexts familiar from daily life (Glynn & Koballa, 2005; Karslı & Yiğit, 2016).

Many people involved in curriculum development and teaching believe that there are considerable benefits associated with context-based approaches (Bennett et al., 2007). However, some questions arise: Does using everyday contexts in science courses help students learn science better? or Does using contexts in the teaching of science subjects improve students' affective characteristics such as attitude or motivation towards science? In particular, it looks at the effects on students' understanding of science and on their attitudes to science (Bennett et al., 2007). In some researches supporting this situation, it has been revealed that this approach is aimed to increase the attitude and motivation of students to the lesson and to attract their interest to science lessons by associating the subjects with the events known from daily life (Barker & Millar, 1999; Gül, Gürbüzoğlu-Yalmancı & Yalmancı, 2017; Hofstein & Kesner, 2006; Karslı & Yiğit, 2016; Kutu & Sözbilir, 2011; Potter & Overton, 2006; Taasoobshirazi, 2007).

Since the CBL approach to science teaching has become increasingly popular because of its positive effects, a few context-based science curricula have been developed in many countries (Ültay & Çalik, 2016). Thereby, these projects have intended to enable the students to conceive how science is related to their daily lives by actively taking their own learning responsibility (Ültay & Çalik, 2016). In order to realize the context-based approach, the REACT strategy was initiated by going over the teachers' views and the sample materials they created (CORD, 1999). In other words, REACT strategy is an output of teachers' observed experiences instead of that of theoretically designed issues (CORD, 1999; Ültay & Çalik, 2016). REACT strategy consists of five stages called relating, experiencing, applying, cooperating, and transferring (Figure 1).

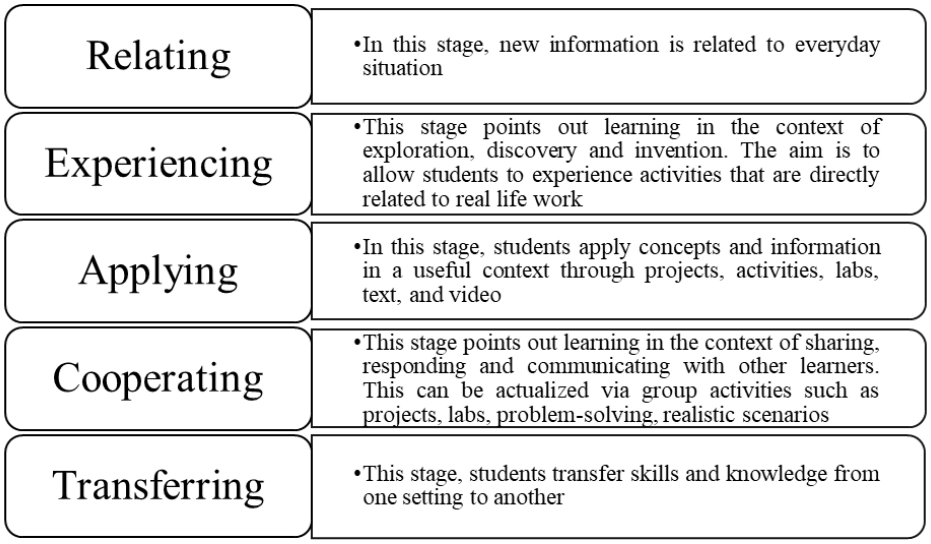

Figure 1: Stages of REACT strategy

The REACT strategy is a teaching model that enables the connection of newly learned concepts with the previous ones and also contributes to the realization of meaningful learning by associating subjects with each other and with daily life (Acar & Yaman, 2011). As in other fields of science, biology subjects are very much connection with daily life (Çimer, 2012). Therefore, the teaching of abstract concepts included in biology subjects to students can be facilitated by biological events that they encounter in daily life (Acar & Yaman, 2011). Since scientific concepts are presented to students with examples from daily life in the REACT strategy, it is aimed to increase students' interest, attitude, motivation and success towards the course and to improve their scientific process skills (Bennett & Lubben, 2006; Campbell, Lubben & Dlamini, 2000; Gül, 2016; Sözbilir & Kutu, 2011). In other words, this model enables students to participate actively in the teaching process and often implemented as a means to improve students' affective responses as well as to develop their cognitive learning outcomes (Broman et al., 2020; Yıldırım & Gültekin, 2017). Therefore, affective domain in addition to the success of the students in the course are the main emphasis of REACT strategy of CBL.

With regard to the affective domain of learning, Koballa and Glynn (2007) state two main constructs; attitudes and motivation, where motivational constructs such as arousal, anxiety, interest and curiosity are mentioned to play important roles. On the other hand, a common result of previous studies on students' attitudes towards science is that attitudes towards science are positive among young children but older students' attitudes become more negative with age (Broman et al., 2020). Of course, a variety of aims has underpinned the development of context-based materials. Arguably, the most significant of the aspirations lies in the area of students' affective responses to science-how they feel about their experiences of science. The hope is that the contexts used to develop scientific ideas will motivate students and make them feel more positive about science by helping them see the importance of what they are studying (Bennett et al., 2007). At this point, teaching of science lessons with context-based approaches like REACT strategy can meet these expectations.

Positive results have been achieved in many studies based on context-based learning that includes REACT strategy (Dağıstanlı & Yıldırım, 2020; Deveci & Karteri, 2020; Özbay and Kayaoğlu, 2015; Saka, 2011). However, the main focus of the majority of these studies has been the impact of the REACT strategy on success (Erdoğan-Karaş, 2019; Karslı & Saka, 2017; Ültay, 2014; Ültay & Çalik, 2016). When researches are examined especially in terms of studies in the field of biology, research findings revealed that the react strategy has a positive effect on success and learning (Erdoğan-Karaş, 2019; Gül et al., 2017; Karslı & Saka, 2017; Karslı-Baydere & Aydın, 2019; Yıldırım & Gültekin, 2017). On the other hand, when the effect of REACT strategy on attitude and motivation is examined, there are very few studies in the field of biology. In these studies, different findings were obtained regarding the effect of react strategy on attitude and motivation. For example, Gül et al. (2017) examined the effect of REACT strategy on the students' motivations towards biology learning in addition to achievements, inquiry learning skills perceptions. The data of this experimental study were collected from totally 58 tenth grade students. According to the findings, it was seen that achievements of the students in experimental groups increased in statistically significant level. In addition, students' inquiry learning skills perceptions was not founded statistically significant. However, it was founded that there was a notable decrease in scores of control group in terms of motivation towards biology learning. Besides, it has been revealed that teaching based on the react strategy does not have a statistically significant effect on the motivation of the experimental group students. In another study, Erdoğan-Karaş (2019) examined the effect of REACT strategy on the seventh graders' attitudes to science course and motivations towards science learning. The study was designed as a quasi-experimental research. The sample of the study consisted of a total of 60 students. As a result of the analysis, it was determined that the average scores of the students before and after the application were generally high in both scales. In the statistical analysis, no significant difference was observed between the experimental and control groups in the attitude scale and the motivation scale. Dağıstanlı and Yıldırım (2020) implemented for the purpose of examining the effect of environment education supported by CBL approach on environmental attitudes, behaviors and success of seventh grade students. Environment education was carried out by using context-based learning approach (REACT strategy) in the experimental group and teacher-centered educational methods in the control group. In the study, it was concluded that environment education supported by context-based learning approach was significantly effective on developing environmental attitudes, behaviors and success of the students. Similarly, Yıldırım and Gültekin (2020)' study was founded that REACT strategy has statically significant effect on the motivation of students; but not statically significant effect on scientific attitude of students. Finally, the findings of another study by Gül (2016) study indicated that the teaching intervention didn't result in statistically significant effects on the students' attitudes and motivations.

When the above findings are evaluated in general, it is seen that similar or different results have been reached in the studies conducted in the field of biology. It is also seen

that the number of studies is quite limited (Demircioğlu, Vural, & Demircioğlu, 2012; Gül et al., 2017). Therefore, the existence of a small number of studies towards the effect of the REACT strategy on teaching biology subjects appears to be a need to investigate the effect of this method on affective characteristics. From this point of view, the effect of teaching with REACT strategy on students' attitudes towards biology science and course lesson and context-based biology motivation was investigated in this research.

3. Purpose of the Research

The aim of this research is to examine the effect of REACT-based instruction on 11th grade students' attitudes towards biology science and biology course and their motivations towards context-based biology. The research questions addressed in this research were as follows:

1) What is the effect of REACT strategy on the 11th grade students' attitudes towards biology science and biology course?
2) What is the effect of REACT strategy on the 11th grade students' motivations towards context-based biology?

4. Material and Methods

4.1. Research Design and Sample

A quasi-experimental design with non-equivalent groups was used in this research (McMillan & Schumacher, 2010). Before the implementation phase of the research, necessary legal permissions were obtained and the Ethics Committee approval certificate was obtained. The sample of this research was totally 50 eleventh-grade students, attending two classes in a public school in the Eastern Anatolia region of Turkey. These two classes were randomly assigned as experimental group (11 females, 13 male), and the control group (13 females, 13 male). The duration of lessons was 4 hours per week (3x4) for 3 weeks, 12 hours in total and two classes were instructed by the same educator (in which the teacher was an observer) who was one of the researchers in this study. All the students participated fully in the study by attending classes, and completing the pre-test and the post-test.

4.2. Data Collection Tools

Data collection tools used in research consists of the 'Biology Science and Course Attitude Scale (BSCAS)' and 'Context-Based Biology Motivation Scale (CBBMS)'. BSCAS with 23 items in three dimensions was improved by Atik, Kayabaşı, Yağcı and Ünlü-Erkoç (2015). The scale includes 5-point Likert-type items consisting of 13 positive and 10 negative statements. The first nine items of the scale (interest dimension) are aimed at measuring students' interest in biology in general, the following eight items (pleasure dimension) are about the pleasure they get from the biology course, and the last six items (anxiety dimension) measure their anxiety to the biology course. Cronbach Alpha internal

consistency coefficient was used to determine the reliability of the scale; .887 for the interest dimension, .897 for the pleasure dimension and .786 for the anxiety dimension. The same coefficient was calculated as .928 for the overall scale.

CBBMS developed by Gül (2019) includes 34 items prepared in a 5-point Likert type. The scale has addressed three dimensions of motivation for learning context-based biology: 'Relating and Impact', 'Participation and Competence' and 'Liking and Satisfaction'. Alpha reliability (Cronbach's alpha) for each dimension was calculated as .898, .914 and .846, respectively. The reliability coefficient for the overall scale was calculated as .943.

4.3. Teaching Intervention

4.3.1. REACT Strategy Based-Teaching Materials and Intervention in the Experimental Group

Three materials (worksheets) were prepared by the researchers taking into account the learning outcomes relating to 'Digestive System' in the biology curriculum. The first learning outcome in curriculum is "It explains the structure, function and functioning of the digestive system" and, the 'Journey of a Morsel' context and questions related to this context were used in the Relating stage of REACT strategy. Thus, the subject is connected with daily life. The Experiencing stage was completed with an experiment aimed at discovering the digestive process, and additional materials and questions prepared for the Applying stage were used. An activity was planned for students to stimulate the digestive system in the Cooperating stage. In the last stage (Transferring), it was aimed to ensure that students transfer what they learned to new situations with the questions prepared.

The second learning outcome in curriculum is "It explains the digestive system disorders" and, the context and questions on 'National Menu Mobilization' were prepared for the Relating stage. The game activity was planned in addition to watching a video with the students and answering the questions for the Experiencing stage. In the Applying stage, it was proposed to use an additional material on digestive system diseases and, to answer the questions together by watching a TV program in the Cooperating stage. Finally, it was aimed to adapt the subject to new situations with the current questions directed to the students in the Transferring stage.

The third learning outcome in curriculum is "It makes inferences about what should be done to protect the healthy structure of the digestive system". For this outcome, the context of 'Doctor's Advice' and the questions associated with the daily life was used in the Relating stage of REACT strategy. For the Experiencing stage, the students conducted an experiment on the ingredients of nutrients. Applying stage, the students were asked to prepare a plate of healthy food that should be eaten 3 meals a day. And was aimed at answering the questions prepared in accordance with the outcome. The homework given to students at the Cooperating stage was be presented in groups in the classroom. In the Transferring stage, as in other learning outcomes, it is aimed to transfer what they have learned to a new situation with the questions directed to the students.

During the material preparation process, various activities, texts and questions in accordance with the five stages of the REACT strategy were enriched using various visuals and designs. The prepared materials and their attachments were also checked by three experts, the necessary corrections were made, and the materials and attachments were finalized.

4.3.2. Intervention in the Control Group

In the control group, the instruction was strictly followed by the textbook. For example, regarding the first learning outcome in the curriculum, at the beginning of the course, the teacher intended to attract the students' attention towards the related topic and to stimulate their pre-existing knowledge through questions. For this aim, introduction to the subject was done with the questions (e.g. why do we have a digestive system?, What is digestion?, In which organ in our body does digestion start?) in division of the preparatory works of the textbook and a discussion environment was created. After the brainstorming and group discussions, the teacher explained subject (e.g. Digestion is a complex process that involved multiple stages. Digestion starts when food is put into the mouth). The teacher explained the steps of digestion and the roles of teeth and the mouth, esophagus, stomach, small intestine, large intestine, and colon in the function of the digestive system. The teacher made his explanations with the presentation projected on the board. In the meantime, the teacher used various visual materials, pictures and digestive models. The course process mainly continued with question-answer method. In addition, worksheets containing various questions and small activities (such as a concept map) were used during the teaching process. The aim of the activities with worksheets was to make the students actively participate in the process. The researcher/teacher adopted the role of guide, showing the students ways to access information rather than providing the information for them during these activities. In general, the teaching activities for the first and second learning outcomes in the curriculum were implemented similarly. However, for the third learning outcome, the students were given a homework in addition to question-answer method, teacher explanations, worksheet activities. Regarding this homework in the textbook, the students created a weekly nutrition chart and discussed the results in class.

4.4. Data Collection and Analysis Process

Both scales were administered to both experimental and control groups as the pre-test one week before the teaching intervention and immediately re-administered as the post-test after the teaching intervention. The teaching intervention in both groups lasted three weeks (4 hours a week) in accordance with the curriculum. According to this, totally 12 hours of lecture planning was made for the teaching of the digestive system. The teaching intervention was implemented through REACT strategy for experimental group students, and the control group students were taught through the curriculum-oriented instruction, which was strictly followed the course book.

SPSS 20.0 statistics program was used in the analysis of the data obtained from the experimental and control groups in the research. Descriptive statistics such as arithmetic mean and standard deviation were examined in the analyzes. In addition, Kolmogorow-Smirnov and Shapiro-Wilk normality tests were performed with skewness and kurtosis values to determine whether the data were suitable for parametric testing for group comparisons. Levene homogeneity test was conducted to determine the homogeneity of variances. Since the obtained analysis results showed that the data are homogeneous and suitable for normal distribution, parametric tests were used in group comparisons. According to this, independent groups t-test was administered so as to find the differences between the groups for the pre-test whereas ANCOVA (Covariance Analysis) was performed so as to determine the differences for the post-test. The ANCOVA used in this study served primarily to adjust for initial differences between groups attributed to the covariates (Al khawaldeh, 2013).

In the research, the skewness and kurtosis values were firstly examined in order to control the compliance of the data to the normal distribution. Accordingly, it is understood that these values are within the desired limits since they are between (-1) and (+1) values suggested by Tabachnick and Fidell (2013). On the other hand, Kolmogorow-Smirnov and Shapiro-Wilk tests are also used to determine the suitability of the data structure to normal distribution. Accordingly, the p value for all data was found to be insignificant and it was seen that the data were suitable for normal distribution.

Table 1: Analysis of compliance of EG and CG data to normal distribution

Group	Treatment	Test	Skewness	Kurtosis	Kolmogorov-Smirnov		Shapiro-Wilk	
					Statistics	*p*	Statistics	*p*
EG	Pre-test	BSCAS	-.145	.081	.110	.200	.985	.963
		CBBMS	-.241	-.807	.163	.098	.965	.544
	Post-test	BSCAS	.347	-.897	.097	.200	.954	.338
		CBBMS	.934	.560	.167	.082	.919	.055
CG	Pre-test	BSCAS	.264	.246	.118	.200	.971	.658
		CBBMS	.001	-.108	.101	.200	.977	.802
	Post-test	BSCAS	-.435	-.273	.147	.153	.943	.157
		CBBMS	.128	-.865	.117	.200	.967	.539

EG: Experimental group, CG: Control group

Levene test was also conducted to check whether the data was homogeneously distributed or not.

Table 2: Levene homogeneity test results of EG and CG data

Instrument	Comparison Group	Treatment	Levene Statistics *(F)*	*p*
BSCAS	EG	Pre-test/Post-test	1.671	.203
	CG	Pre-test/Post-test	3.001	.098
	EG-CG	Pre-test	.045	.833
	EG-CG	Post-test	.136	.714

CBBMS	EG	Pre-test/Post-test	1.154	.288
	CG	Pre-test/Post-test	.015	.904
	EG-CG	Pre-test	.056	.814
	EG-CG	Post-test	1.044	.312

The results given above revealed that the data obtained from each measurement tool was homogeneously distributed in all comparisons (Table 2). Accordingly, the findings for each sub-problem are presented below, respectively.

5. Results

5.1. Results for the First Research Question

In line with the first research question, BSCAS was applied to the students in EG and CG as pre-test and post-test. BSCAS pre-test and post-test scores were calculated for EG and CG, and the results are shown in Table 3.

Table 3: Comparison of EG and CG students' pre-test and post-test BSCAS scores

Groups	**Treatment**	$\overline{X}$	**sd**
EG	Pre-test	2.59	.53
	Post-test	3.18	.37
CG	Pre-test	2.70	.55
	Post-test	2.88	.38

Maximum score: 5

As is clear from Table 3, the students in CG have higher scores in the pre-test. Independent groups t-test was given so as to find whether or not there were any differences between CG and EG in pre-test scores, and the results are shown in Table 4.

Table 4: Differences between groups in terms of pre-test scores

Groups	**N**	$\overline{X}$	**sd**	**t**	**p**
EG	24	2.59	.53	-.766	.448
CG	26	2.70	.55		

According to Table 4, it was found that there were no significant differences between CG and EG in terms of pre-test scores ($t_{(48)}$= -.766, p>.05). This showed that the groups had similar properties. Even though there were no significant differences between the groups in terms of pre-test scores in this study, it was found that the CG had higher average. Therefore, ANCOVA was performed so as to check the effects of pre-test on post-test in determining whether there were any significant differences between CG and EG in terms of Post-test BSCAS scores (Topu & Goktas, 2019). ANCOVA results were presented in Table 5.

Table 5: ANCOVA analysis results for EG and CG students' post-test BSCAS scores

Variance Source	Sum of Squares	df	Mean Squares	F	p
Pre-test (Covariate)	.274	1	.274	1.975	.166
Groups	1.178	1	1.178	8.494	.005*
Error	6.521	47	.139		
Total	464.936	50			

* p< .05

As is evident from Table 5, there are a significant difference between CG and EG in terms of corrected post-test BSCAS scores ($F_{(1-47)} = 8.494$, $p< .05$). According to the findings, the post-test scores of the EG were found to be higher. This result reveals that the REACT strategy affects students' attitudes positively.

5.2. Results for the Second Research Question

In line with the second research question, CBBMS was applied to the students in EG and CG as pre-test and post-test. CBBMS pre-test and post-test scores were calculated for EG and CG, and the results are shown in Table 6.

Table 6: Comparison of EG and CG students' pre-test and post-test CBBMS scores

Groups	Treatment	$\overline{X}$	sd
EG	Pre-test	2.29	.54
	Post-test	2.80	.79
CG	Pre-test	2.37	.62
	Post-test	2.36	.54

Maximum score: 5

As is clear from Table 6, the students in CG have higher scores in the pre-test. Independent groups t-test was given so as to find whether or not there were any differences between CG and EG in pre-test scores, and the results are shown in Table 7.

Table 7: Differences between groups in terms of pre-test scores

Groups	N	$\overline{X}$	sd	t	p
EG	24	2.29	.54	-.475	.637
CG	26	2.37	.62		

According to Table 7, it was found that there were no significant differences between CG and EG in terms of pre-test scores ($t_{(48)=}$ -.475, p>.05). This showed that the groups had similar properties. Even though there were no significant differences between the groups in terms of pre-test scores in this study, it was found that the CG had higher average. Therefore, ANCOVA was performed so as to check the effects of pre-test on post-test in determining whether there were any significant differences between CG and EG in terms of Post-test CBBMS scores (Topu & Goktas, 2019). ANCOVA results were presented in Table 8.

Table 8: ANCOVA results for EG and CG students' post-test CBBMS sScores

Variance Source	Sum of Squares	df	Mean Squares	F	p
Pre-test (Covariate)	.018	1	.018	.040	.843
Groups	2.333	1	2.333	5.071	.029*
Error	21.622	47	.460		
Total	355.165	50			

* p< .05

As is evident from Table 8, there are a significant difference between CG and EG in terms of corrected post-test CBBMS scores ($F_{(1-47)} = 5.070$, $p < .05$). According to the findings, the post-test scores of the EG were found to be higher. This result reveals that the REACT strategy affects students' motivations positively.

6. Discussion

In this research, the effect of context-based learning using REACT strategy on students' attitudes towards biology science and course and motivation towards context-based biology was examined.

In line with the first research question, it was examined the effect of REACT strategy on the students' attitudes towards biology science and biology course. According to the findings obtained from pre-tests, EG and CG students' attitudes are similar to each other before the teaching intervention. At the end of the teaching process, while there was an increase of approximately 7% in the attitude scores of the CG, the rate of increase in the attitude scores of the EG was approximately 23%. Of course, considering that the change in attitudes takes place in the long run (Yıldırım & Gültekin, 2017), the increase achieved in this research can be considered as a very pleasing result in order to meet the expectations targeted in the research. Therefore, it is possible to say that teaching based on REACT strategy has a positive effect on students' attitudes towards biology science and course. However, the point that needs to be examined is that curriculum-oriented instruction has not a significant effect on student' attitudes. As stated before, curriculum-oriented instruction, which is based on constructivist approach, was carried out in the control group. The textbook was strictly followed during the instruction period. In some research of similar nature in the literature, it has been determined that this method does not have a significant effect on attitudes (Ayaz & Şekerci, 2015; Özgen & Alkan, 2014; Ünal & Çelikkaya, 2009; Erdoğan-Karaş, 2019; Ültay, 2012). Many of these researches suggested that this result was because of reasons such as the high level of initial attitudes of the students, the difficulty in changing attitudes in a short time, etc. Of course, the fact that the activities in this research were limited to three weeks may be one of the reasons why the attitudes did not differ significantly. However, although the time factor is an important factor in the change of attitudes, the relationship between the attitudes and other factors such as students' interest in the method, the increase in the interest of the materials in the lesson, and the course success should be taken into consideration. As a matter of fact, the textbook was strictly followed and the it did not contain a sufficient

number of activities. For example, no experiments or activities related to the first learning outcome (It explains the structure, function and functioning of the digestive system) were included in the textbook. In line with the content followed in the book, question-answer and discussion methods were often used in the teaching process. In addition, during the lesson, students were provided with visuals with diagrams, figures and different course materials, and they included homework that students would work together and individually. The evaluation process was provided by the questions in the textbook. This situation necessitates the revision of the textbooks. Accordingly, it is important that the textbooks are prepared in accordance with the curriculum based on the constructivist approach. Therefore, textbooks should be frequently included in activities that stimulate students' prior knowledge, involve research and collaborative activities, and using interesting and intriguing questions.

As a matter of fact, the positive impact of these activities was clearly seen in the experimental group where the REACT strategy was used. In study, the students expressed their positive opinions during interviews which were not included in this research. They explained the positive effect of using of the cooperative practices in the homework and the activity process, and materials/worksheets including contexts related to daily life on their attitudes. There are studies in the literature that reveal the positive effects of REACT strategy on attitudes (Dağıstanlı & Yıldırım, 2020; Saka, 2011; Ültay, 2014; Yıldırım & Gültekin, 2017). On the other hand, there are occasional findings of different studies indicating that activities based on the REACT strategy do not have a significant effect on attitudes (Demircioğlu, Asik, & Yilmaz, 2019; Erdoğan-Karaş, 2019; Gül, 2016; Ültay, 2012). These studies mostly associated the lack of change in attitudes with the time factor. Of course, although the time factor is thought to be an important factor in changing attitudes, it may be too ambitious to say that this alone is sufficient. Because the findings of many studies reveal that there is a positive and significant relationship between course success and attitude (Tabuk, 2019). As a matter of fact, Çetin (2011) expressed similar views on this issue by stating that the most important determinant of attitudes is the cognitive factor. Similarly, Bennett et al. (2007) stated when students become more interested and more motivated due to their experiences in a context-based course, one may expect that these increased affective responses would result in higher engagement and understanding of science. Therefore, in this research, the positive effect of the REACT strategy on students' attitudes towards the course can be associated with its positive effect on achievement. Because, although the scope of this study is not included, the positive effects of the method on student achievement were also determined. Of course, because of the fact that the number of studies examining the effect of teaching based on REACT strategy on student attitudes is still limited (Dağıstanlı & Yıldırım, 2020; Erdoğan-Karaş, 2019; Gül, 2016; Saka, 2011; Ültay, 2014;), more researches need to be done to pinpoint main causes.

In line with the second research question, it was examined the effect of REACT strategy on the students' context-based biology motivations. According to the findings obtained from pre-tests, EG and CG students' motivations are similar to each other before

the teaching intervention. At the end of the teaching process, almost no change was observed in the scores of the CG, while an increase of 22% was observed in the motivation scores of the EG students. In this case, it can be said that teaching based on REACT strategy may have positively affected students' motivations. In a research supporting this finding, the students stated that they were more motivated in the teaching environments using teaching materials developed in accordance with the REACT strategy of the CBL model (Utami, Sumarmi, Ruja, & Utaya, 2016). Sjøberg and Schreiner (2012) stated that science courses should be made based on context. Thus, it has been suggested that students' awareness of science and the purpose of science courses will increase by discussing the knowledge they have with other friends in the teaching environments designed in this way.

Although there are studies examining the effect of context-based learning in the literature (Baran, 2013; Choi & Johnson, 2005; Kuhn & Müller, 2014; Kutu & Sözbilir, 2011; Magwilang, 2016; Vaino, Holbrook, & Rannikmäe, 2012), it is clear that there are not enough studies examining the effect of the REACT strategy on student motivation (Dağıstanlı & Yıldırım, 2020; Demircioğlu et al., 2019; Erdoğan-Karaş, 2019). For this reason, it is not yet possible to make a definite conclusion that this method can have a positive effect on motivation in most cases. Despite the positive effect revealed in this study, the different studies were found that the REACT strategy has no positive effect on motivation (Demircioğlu et al., 2019; Erdoğan-Karaş, 2019; Gül, 2016; Gül et al., 2017; Keleş, 2019). According to Acar and Yaman (2011), the reason for this situation is that students are more interested in science in small classes and as their class level increases, their interest decreases. Baran (2013) was similarly stated with the fact that students' motivation could be related to their level of interest. Baran (2013) also stated that increasing the level of motivation of students with little interest will become more difficult and therefore their adaptation to the situation will decrease further. At this point, as stated by Ramsden (1992), students' interest in lessons can be increased if context-based learning activities towards the interests of students in their daily lives are used, especially in science lessons.

As a result, the lack of a positive effect of the react strategy on motivation has been associated with different reasons in the above sample studies. However, some researchers concluded that the REACT strategy had a significant positive effect on motivation (Özbay & Kahyaoğlu (2015), Ültay, Güngören, & Ültay (2017) and Yıldırım and Gültekin (2017). The increase in student motivation in this research can be regarded as a positive finding. As a matter of fact, Bennett and Holman (2003) stated that one of the important features that stand out in context-based lessons in order to ensure that the information provided in the teaching process is understood by students is the motivational aspect of the method. These researchers drew attention to the positive effect of the method on motivation, emphasizing that if students can see the main idea of what they are working on, they can use the content and learn more effectively. On the other hand, the fact that REACT strategy-based activities have a positive effect on student motivation may be related to the structure of the scale used in this research. When the

literature is examined, it seems that the scales used in the studies examining the effect of REACT strategy on student motivation has the purpose of measuring motivation towards the course. Whereas, the scale used in this research does not directly measure the motivations for biology course, but measures the motivation of students towards context-based biology. In other words, this contrast may have stemmed from the CBBMS structure with more specific statements that differ from standard scales with ordinary statements (i.e., I understand the biology topics more quickly when the teacher tells these subjects by linking them with everyday life.). Therefore, determining the motivation towards biology which is intertwined with our daily life, using a measurement tool that takes a context-based approach, can further increase the reliability of these research findings (Gül, 2019). Therefore, it is important to continue similar studies using this measurement tool in order to reveal the effect of the method on motivation more clearly. The fact that students' motivations did not change in the control group should be considered as a situation that should be discussed. Because, when the studies on the effects of constructivist learning environments on motivation in the literature are examined, it is seen that mostly positive findings are encountered (İlter & Ünal, 2014; Wilder & Shuttleworth, 2004). Therefore, it is a finding that should be emphasized that student motivations did not change in the control group in this research. Because, with the changes made in the educational programs by the Ministry of National Education in our country in recent years, the constructivist learning approach has been taken as a basis in educational institutions. Since constructivism is based on a student-centered learning approach, the concept of motivation, which is thought to encourage students' active participation in the process, becomes even more important (Balantekin & Bilgin, 2017). In the learning environments used by this approach, the students' cognitive developments are supported because they are guided to learn by thinking rather than using by heart the information provided to them. Therefore, students may see learning as a mysterious process to be discovered rather than a difficult process to overcome. This situation increases their motivation, so they can turn to new and different learning activities (Erdoğan-Karaş, 2019). However, the findings of this research indicated that the motivation levels of the students do not change positively despite the positive effects of the constructivist approach. This is an important finding that should be emphasized. Balantekin and Bilgin (2017) interpreted this situation as learning activities in schools are carried out based on guidebooks and that the elements that increase the motivation of students are not included at a sufficient level. At this point, although it is prepared on the basis of the constructivist learning environment, it can be said that, in addition to the textbooks, there is a need to develop different teaching materials that can increase the motivation of the student in learning environments.

On the other hand, in another research conducted by Teyfur and Teyfur (2012), they stated that although administrators and teachers adopt this approach, schools are insufficient in terms of infrastructure and they have difficulties in applying this approach in learning environments due to classroom management problems caused by crowded classrooms. One of the most important reasons of this situation has been put forward as

the lack of any physical change or arrangement in the construction of schools / buildings and classrooms in accordance with the constructivist approach until today. For this reason, it was suggested that teachers should cooperate effectively with their colleagues both in and outside of the classroom, and teachers should be supported by the school administration. Similarly, in a research conducted by Cetin-Dindar (2015), the motivations of students against learning science with a constructivist approach were discussed. In the research, it was concluded that students' motivation decreased in an educational environment where constructivist understanding was intense. It was stated that among the reasons for this decrease, students 'familiarity with the teacher-centered teaching environment, which they are accustomed to since the primary school age, and students' taking more responsibility in their course activities.

As a result, it can be said that the activities based on constructivist approach in essence were implemented in both experimental and control groups. However, the absence of a change in students' attitudes and motivations in the control group gives a clue that the textbooks prepared on the constructivist approach should be reviewed. As a matter of fact, in some studies conducted in our country, it is emphasized that the textbooks have some deficiencies in terms of conformity with the constructivist approach (Gökkulu, 2015). Ültay and Çalık (2016) examined the effect of the 5E model of the constructivist approach with the REACT strategy and reached similar results to this study. The researchers suggested that 5E model of the constructivist approach needs to be revised in the context of our country. Findings in the experimental group can generally be interpreted as the REACT strategy contributes to curriculum-based instruction, especially through contexts from daily life. As a matter of fact, it was determined that context-based instruction contributed more to the constructivist learning environment in a study by İlhan (2010).

7. Conclusion

In context-based teaching environments, scientific concepts are presented to students with examples related to daily life, and it is aimed to increase students' interest, attitude, motivation and success towards the course and to improve their scientific process skills (Bennett & Lubben, 2006; Campbell et al., 2000; Gül, 2016; Kang et al., 2019; Yu, Fan, & Lin, 2015). Accordingly, when the findings presented above regarding the effect of REACT strategy of context-based learning on students' attitudes and motivations are evaluated in general, it can be said that the method is useful, and the aims expressed in the literature have been achieved at the end of this research. However, this research has some limitations given below.

7.1. Limitations of the Study

This research was implemented with at a public school in the Eastern Anatolia region of Turkey. Data from other regions, different school types or education levels may provide

different results. Additionally, conducting a similar study with larger sample groups can increase the generalizability of the research.

The dependent variables of this research are limited by attitude and motivation. Because of these limitations, further research can be recommended. For example, the effectiveness of the method can be investigated in terms of cognitive characteristics such as knowledge, achievement, problem solving skills in addition to different affective characteristics as interest, perception, self-efficacy etc. Besides, a retention test could be administered to determine whether the method used ensured long-term retention of attitude and motivation.

Another limitation is that this research was conducted on the "Digestive System" subject in the eleventh-grade curriculum. Almost every subject of biology is closely related to everyday life. Besides, different studies have been conducted on biology subjects at different levels of primary and secondary education. Considering the limited number of these studies, it can be said that more studies are needed on this subject. Therefore, the effectiveness of the method can be investigated in different biology subjects or the two instructional methods can be conducted during a whole semester. Students' opinions about both methods can be taken by face-to-face interviews.

The worksheets/ materials used in experimental group should be piloted in different groups before the actual application. Thus, it can be evaluated according to criteria such as understandability, applicability, and suitability of the content, and it can be updated both in terms of time planning before implementation and in terms of different physical features such as design.

8. Educational Implications

In the research, no significant differences were observed between the pre-test and post-test applications of all measurement tools used in the control group where the practices based on textbook-oriented instruction were carried out in our schools. This situation can be considered as an indication that there are still some deficiencies at the point of application, although the textbooks are prepared based on the constructivist approach. As a matter of fact, some studies are suggested that the constructivist approach needs to be revised in the context of our country. At this point, especially textbooks should be carefully prepared.

The research presented here revealed that the REACT strategy contributed more to the constructivist learning environment improve students' attitudes and motivations. The curriculum should include more everyday contexts.

Conflict of Interest Statement

The authors declare no conflicts of interests.

About the Author

Şeyda Gül is an Assoc. Prof. at Ataturk University, Erzurum, Turkey. He is currently working at the Biology Department at the same university. She works on science education in general and biology education in particular. Her interests are in REACT strategy, computer assisted teaching, statistics and scale development.

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