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THE EFFECT OF DESIGN-BASED ACTIVITIES PREPARED WITH THE REACT STRATEGY ON SECONDARY 7TH GRADE STUDENTS' 21ST CENTURY SKILLS AND SCIENCE ATTITUDES

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ABSTRACT

The effect of the recently popular REACT strategy on the 21st-century skills and science attitudes of secondary school 7th-grade students has been investigated in this study. A quantitative research method of quasi-experimental design with a pre-test post-test experimental control group was devised for this research. In this context, an experimental group and a control group were formed. While activities were applied with the REACT model to the experimental group, teaching techniques consisting of traditional methods were applied to the control group. Fifty-four students in a public school located in Turkey's Western Black Sea Region participated in the research. Students were picked up by a random sampling method to ensure validity and reliability. Through the quantitative data collection tools used in this study, students' "21st century skills" and "attitudes towards science studies" were examined using two different scales. For this purpose, the 21st century skills scale and the Science and Technology attitude scale were used. The data collected in the study have been analyzed with descriptive and inferential statistical techniques. Research has found that students in the experimental group diverted significantly in 21st-century skills and science attitudes from those in the control group in a positive way. Accordingly, it can be suggested that more usage of design-based activities in science education and increase in applications that activate students' creative thinking processes should be encouraged.

Keywords: REACT Strategy, 21st-Century Skills, Science Education, Science Attitude.

INTRODUCTION

Curricula are updated from time to time and novel approaches are introduced to improve the quality of science education in the light of research by experts. The idea of learning outcomes should be supported with 21st-century learning approaches has been emphasized when revisions of secondary school science classes were examined. Therefore, it is necessary to develop strategies to implement these novel learning approaches. Because a chosen strategy defines the methods for how to teach students new subjects and to help them acquire new knowledge within the frame of teaching theories while also guiding such methods and ensuring the endurance of knowledge gained.

The REACT strategy learning approach helps students' reveal their "scientific creative thinking" potential as well as develop skills for the scientific process, such as hypothesizing, theory set up and experiment. This learning approach, as a result, contributes to the educational processes by providing students with the experience of various design-based learning activities (Tatlı &Bilir, 2019). It has been pinpointed in the related line of literature that those materials designed by secondary school students are teaching activities that develop their scientific creative thinking skills and that include theory at the minimum and practice at the maximum. Students improve their scientific process skills while preparing such materials as they go through observing, measuring, hypotheses forming, theory construction, reasoning, experimenting, interpreting, and conclusion drawing.

REACT Strategy

The REACT strategy, which is used as a teaching model by researchers like Crawford (2001) and Navarra (2006), has become one of the trending and widespread learning approaches in recent years. The "REACT" concept is an acronym formed by the initials of learning stages Relating, Experiencing,

Applying, Cooperating and Transferring. These “REACT” learning stages are defined in brief as the following:

Relating: Learning new knowledge by establishing contexts relevant to daily life
Experiencing: Learning through exploration and experience using life experiences
Applying: Learning through activities such as projects, problem-solving and lab activities
Cooperating: Learning through communication and interaction with other students
Transferring: Learning by transferring previous knowledge to solve problems

The REACT strategy is based on learning approaches such as learning styles and interdisciplinary differences (Kolb, 1981), multiple intelligences theory (Gardner & Hatch, 1989), and brain-based learning (Caine & Caine, 1993; Navarra, 2006). It is also consistent with learning systems (Karamustafaoğlu & Tutar, 2018) as wider frame learning styles: (theory, psychometry, research, practice) inventory (Kolb & Kolb, 2013), STEM (Çepni, 2017; Korkmaz et al., 2021), and out-of-school learning environments (Laçin-Şimşek, 2020).

Importance of REACT Strategy

Finkelstein (2001) accentuated contexts should be associated with the content and consider students' prior knowledge. It has also been stressed that these contexts should be chosen so to enhance a student's motivation. Therefore, the REACT strategy proves to be the most appropriate method for applying the context-based teaching approach, which can also be adapted to different methods.

The REACT strategy components cycle is implemented as seen in Figure 1. In this cycle, places of components E (Experience), A (Applying) and C (Cooperating) can be interchanged; namely, they can act in an alternating manner. They can be used in diverse ways during the teaching process. However, it is advisable to change, specifically, places for components R (Relating) and T (Transferring) during the application.

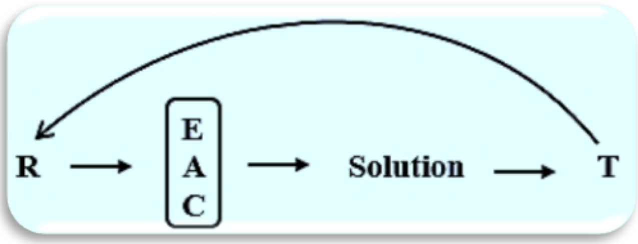

Figure 1. The Cyclical Process of The REACT Strategy (Navarra, 2006)

Learning outcomes gained through establishing relations between a newly acquired knowledge and those learnt by context-based approach in daily life are employed for solving problems encountered afterwards. In other words, principles learnt in a context can be used to solve problems confronted in other contexts. However, some naïve behaviors can be observed from those exceptionally talented and successful students if experience and knowledge principles are parted from the context. Hence, students experience less difficulty in their classes with higher motivation if teachers choose tools amongst those useful for solving real life problems, while they present such principles to students. It has been stated that REACT strategy stages are realized by learning by doing context and with students' scientific process skills. Students embrace the question and prefer active learning rather than passive when they do their research. In this way, both easier and faster learning can be realized, and information can be preserved for a longer time (Navarra, 2006).

Various studies on the positive effects of some scientific skills achieved by students through REACT strategy, context-based learning approach, have been carried out (Aktamış & Ergin, 2008; Altınpulluk & Yıldırım, 2021; Bybee, 2010; Demircioğlu et al., 2019; Günter, 2018; Irzik & Nola, 2014; Karslı & Yiğit, 2016; Keleş & Dede, 2020; Putri et al., 2019; Ültay & Çalık, 2011). Common to these studies that they have similar aims and results in general. However, no research has been found in the literature, which studied the effect of REACT strategy on scientific creative thinking skills and scientific process skills of secondary school students. It is anticipated, consequently, that this study will shed light on future research on the subject and contribute to the existing body of knowledge.

Literature Review

The Center of Occupational Research and Development (CORD) conducted research to observe science and mathematics teachers who use a constructivist learning approach to increase success rates in their classes Cord (1999). It was seen that teachers who thought basic concepts should be taught first applied various strategies by making connections between daily life and course subjects. As a result, CORD has described these approaches as basic constructivism principles, coined them as contextual learning strategies and started to use them in teaching programs (Crawford, 2001).

It has been witnessed that the success of context-based learning strategies in activities conducted jointly at each stage of REACT strategy, i.e., establishing relationships, experiencing, applying, collaborating, and transferring, stems from raising qualified students. The Ministry of National Education (MoNE) of Turkey emphasizes the importance of the fact that students become science literate because of revisions made in the curricula. Students develop research, inquiry, criticism, problem-solving, creative thinking, deduction, and decision-making skills after becoming fully science-literate. In addition, abilities such as being aware of lifelong learning, adapting the learnt science knowledge to everyday life, curiosity about the surroundings they live in, and struggling to understand it are among the characteristics of science-literate individuals (MoNE, 2005).

Similar cases are encountered in another learning approach, the STEM education system. This is because such applied learning approaches aim to boost traits such as curiosity, creative thinking, research, problem-solving, communication, adaptation, sharing and using the information in daily life, which are also known as 21st-century skills (Çepni, 2017). Likewise, thanks to engineering, which is one of the fields that make up STEM (Korkmaz et al., 2021), students elevate their science achievement level with their own experiences.

Numerous studies have been conducted on learning approaches that have a role in students' being literate in science education. The most prominent among those is the context-based learning approach. This approach increases an individual's desire to learn science and their motivation and interest in science education. It also establishes a link between real life and science education and warrants the development of scientific process skills (Karamustafaoğlu & Tutar, 2018).

It has been observed that there has been an increase in master's theses in the last five years, whereas studies on the REACT strategy were initially mostly presented as doctoral theses. Studies in different disciplinary fields are equally distributed. In particular, it was observed that studies on force, motion, light in physics, and systems in our body in biology were intensive (Pınar & Dönel Akgül, 2023)

Today, education systems stay away from rote learning in the teaching and learning processes to enable individuals to participate in the learning process actively. The REACT strategy itself is based on realizing this very goal. Thus, students can learn by establishing contexts with daily life instead of merely memorizing and start using this knowledge in their life (Bulte, Westbroek, De Jong & Pilot, 2006; Demircioğlu et al., 2012).

As a context-based approach, REACT strategy is a learning approach that provides learning via associating science education concepts of activities with various contexts and daily life. Therefore, materials designed according to this approach add to students' science attitudes and academic success. In addition, it is stated that the context-based approach is effective in concept learning and the permanence of the learnt knowledge. (Karslı & Saka, 2017). REACT strategy helps learning new knowledge rather than memorizing and about how to use them, when necessary, by establishing links to daily life applying. Besides, it is stated that all students participating in learning environments constituted with REACT strategy can internalize the given information (Ültay & Çalık, 2011).

Science courses are found difficult by the majority of students. It is because relatively more traditional teaching methods are used in these classes, and students show less interest to them (Bennett et al., 2005; Cabbar & Senel, 2020; Gilbert et al., 2011; Karslı & Saka, 2017; Kaya & Rose, 2021; Tariq & Saeed, 2021; Utami et al., 2016). Moreover, studies show that concepts taught in schools are not sufficiently related to daily events (Barker & Millar, 1999). As it has been shared earlier in this paper, curricula in Turkey are updated when needed by the Ministry of National Education (e.g., in years 2006, 2013, 2018). For example, the behavioral theory which was proposed in the 2006 science and technology curriculum (MoNE, 2005) had been applied for years up until it was replaced by the constructivist approach in the 2013 science curriculum (MoNE, 2013). In the 2018 science curriculum (MoNE, 2018), on the other hand, it is intended to help students acquire 21st-century skills through a constructive and innovative learning model.

The aim of the learning outcomes in the Science curriculum is to help students establish daily life connections with the activities and to help them improve themselves by making the information they learn experiential (MoNE, 2018). In the Life-Based Learning approach, science education is carried out in a way that is closely related to daily life (Aslangiray & Usta Gezer, 2023)

The latest curriculum (MoNE, 2018) intends to equip students with skills in three different areas. These are life skills, engineering skills, and scientific process skills. Those works done through communication, cooperation, data access and usage by individuals, which requires analytical thinking, are included in life skills. Activities within mathematical and technological subjects, which aim to raise individuals who can produce innovative products are found in engineering skills. Finally, studies such as hypothesis generation, observation, experimentation, and examination, which are frequently used in scientific studies, are embedded in scientific process skills (Kaya, Kaltakçı Güler, 2024; Tatlı & Bilir, 2019).

According to a study conducted by Karslı-Baydere and Aydin (2019), the REACT technique is effective in teaching seventh-grade students the subject of 'eye' by looking at the students' pre-test and post-test results. The results put forward that presenting a subject known from daily life by associating it with the objects chosen as the context in the research (glasses and camera) is meaningful and purposeful. This indicates that contexts affect concretizing abstract concepts. Because when the subjects are presented concerning daily life, they become more accessible for learners (Bulte et al., 2006; Gilbert et al., 2011; Karslı & Saka, 2017).

A study conducted by Tatlı and Bilir (2019) put forth that several high school students are reluctant to attend classes, arguing that context-based teaching is very time-consuming and incompatible when preparing for university entrance exams, which are national-level high-stakes evaluations. Students, who think that the model is too demanding and overloaded with information, claim that it does not contribute to their development while they are busy enough studying university entrance exams. Some high school teachers state that this learning approach is too time-consuming because the classrooms in which they try to do the activities are overcrowded. Nonetheless, context-based discussions can always have the potential to change students' knowledge levels and perspectives and increase their interest in classes. Students can quickly reflect their knowledge, achievements, and skills in context-based lessons to daily life. Within this framework, the research problem entails investigating the effects of design-based activities prepared using the REACT strategy on the 21st-century skills and science attitudes of secondary school 7th-grade students. The following are the sub-problems that the research is addressing:

1. Is there a statistically significant difference between the post-test scores of students in the experimental and control groups when gender variables are considered?
2. Are there statistically significant differences between the pre-test and post-test results in the experimental group when it comes to gaining 21st-century skills?
3. Regarding students in the control group, is there a statistically significant difference between their pre-test and post-test scores regarding 21st-century skills?
4. In terms of 21st-century skills, is there a statistically significant difference between the post-test scores of the students in the experimental and control groups?
5. Is there a significant difference between the pre-test and post-test scores of the students in the control group in terms of science attitudes?
6. When it comes to students' science attitudes, is there a statistically significant difference between the post-test scores in the experimental and control groups?
7. Considering the post-test scores in the control and experimental groups, what level of correlation is there between 21st-century skills and science attitudes?

METHOD

Research Design

This study employed a quasi-experimental design, one of the quantitative research methods, with a pre-test post-test and experimental/control groups. When the relevant literature is reviewed, it is apparent that the experimental pattern is frequently preferred in studies with cause-effect relationships. Furthermore, it is often emphasized that experimental methods are competent in precision and scientific credibility (Cohen et al., 2007).

Study Group

Fifty-four 7th grade students, enrolled at a public school in Turkey's Western Black Sea Region, participated in the study in the 2022-2023 academic year. Students were selected using a random sampling method to ensure validity and reliability. It is crucial to determine the study group in unbiased in experimental research. The objective determination of the study group affects both validity and reliability (Canbazoğlu-Bilici, 2019). There are twenty-seven students separately in the experimental and control groups of the research. Gender characteristics of the study group are presented in Table 1.

Table 1. Gender Characteristics of the Study Group

Gender	Experiment	Control	f	%
Female	15	12	27	50.0
Male	12	15	27	50.0

Data Collection Tools

21st-century skills and science attitudes of secondary school 7th-grade students have been examined in two different scales within the scope of this study. The relevant literature was reviewed in this context, and the scales thought to serve best to the purpose were chosen. The data collection tools are application tools whose validity and reliability have already been verified. The first scale used is the 21st-century skills scale developed by Mete (2021). The scale, which had been created with the participation of 890 students, comprises a single factor and twelve items. The total explained variance of the scale is 49.85%, and the Cronbach Alpha internal consistency coefficient is .81. The value ranges of the scale are "Definitely inappropriate, Inappropriate, Not sure, Appropriate, Definitely Appropriate".

This research also uses the scale of Science and Technology Attitude developed by Keçeci and Kırbağ-Zengin (2015) as the second data collection tool. The scale above is made up of forty items and three factors. These factors are named as a "passion for science and technology", "curiosity about science and technology", and "desire to integrate science and technology into everyday activities". The total explained variance of the scale is 61.77%. Whilst the Cronbach Alpha reliability coefficient is .90. The value ranges of the scale are "Strongly disagree", "Disagree", "No opinion", "Agree", and "Strongly agree".

Data Collection and Implementation Process

The study data were collected in eight weeks. Firstly, this stage applied the 21st-century skills and the attitude scale as a pre-test. Then, design-based activities prepared with the REACT strategy were used in the experimental group. Alternatively, science activities were carried out in lab sessions with the control group using traditional teaching methods. The activities were performed for six weeks for both groups. Finally, the 21st-century skills and the attitude scale were applied as a post-test in the last week of the research. Figure 2 and Figure 3 are pictures from the experimental and control groups.

Figure 2. Scenes from studies of experimental group

Figure 3. Scenes from control group classes

Data Analysis

The data obtained during the research process were collected using quantitative data collection tools. For this reason, quantitative data analysis methods were applied in the data analysis phase. To begin with, descriptive analyses were made, and then the analysis of inferential statistics was preferred. Parametric tests were used because of the normal distribution of the application data, the homogeneous distribution of the variances and the absence of extreme values (Fraenkel et al., 2011). The experimental and control group applications were analyzed using an independent sample t-test. The association between 21st-century talents and science attitudes was examined using Pearson product-moment correlation and simple linear correlation (Creswell, 2014).

Validity and Reliability

Within the scope of this research, some measures were taken to maximize validity and reliability. These measures can be expressed as the following:

1. First, expert opinions were taken at all stages of the research.
2. Care was taken to ensure that the data collection tools were valid and dependable.
3. Participants were selected impartially to ensure the internal reliability of the research.
4. Presenting research data clearly and in detail is an element that supports internal reliability.
5. Reliability and credibility criteria were also provided by presenting raw data (application pictures, activity stages) for the implementation process.

FINDINGS

In this section, data obtained within research are presented in order, considering the problem cases.

Table 2. Results for the First Problem Case

Groups	Gender	N	$\bar{X}$	Sd	Df	t	p
21st Century Skill Experiment Post-test	Female	30	56.50	3.25	52	-.098	.922
	Male	24	56.58	2.90			
Science attitude Experiment Post-test	Female	30	107.70	15.40	52	.835	.408
	Male	24	104.50	11.98			
21st Century Skill Control Post-test	Female	30	52.36	4.39	52	1.005	.320
	Male	24	51.08	4.97			
Science attitude Control Post-test	Female	30	97.90	11.38	52	.364	.717
	Male	24	96.62	14.34			

Table 2 shows no significant difference in the gender variable of the participants between the experimental and control groups (p>.005). Despite this, females seem to get slightly higher scores than males. Male and female participants have similar views.

Table 3. Results for the Second Problem Case

Groups	Test	N	$\bar{X}$	Sd	Df	t	p
21st-Century Skill	Experiment Pre-test	27	48.85	3.89	52	-9.993	.000
	Experiment Post-test	27	57.88	2.62			

Table 3 shows a significant difference in the experimental group's pre-test and post-test results in 21st-century skills [t (52) = -9.933, p=0.000].

Table 4. Results for the Third Problem Case

Groups	Test	N	$\bar{X}$	Sd	Df	t	p
21st-Century Skill	Control Pre-test	27	48.14	4.79	52	-4.176	.001
	Control Post-test	27	53.29	4.25			

Through scrutinizing the data that Table 4 shares, it has been determined that there is a significant difference [t (52) = -4.176, p<0.001] between the pre-test and post-test results of the students in the control group in terms of 21st-century skills. This difference was slightly lower than that of the experimental group, though.

Table 5. Results for the Fourth Problem Case

Groups	Test	N	$\bar{X}$	Sd	Df	t	p
21st-Century Skill	Experiment Post-test	27	57.88	2.62	52	-4.779	.000
	Control Post-test	27	53.29	4.25			

Looking at Table 5, one can dwell on that there is a significant difference between the post-test results of the students in the experimental group and the control group [t (52) = -4.779, p<0.000] in favor of the experimental group in terms of 21st-century skills. This difference italicizes that the experimental group's students have higher averages.

Table 6. Results for the Fifth Problem Case

Groups	Test	N	$\bar{X}$	Sd	Df	t	p
Science attitude	Experiment Pre-test	27	78.07	4.45	52	-12.458	.000
	Experiment Post-test	27	99.92	7.95			

Table 6 reveals a significant difference in science attitudes between the pre-test and post-test results of the students in the experimental group [t (52) = -12.458, p=0.000].

Table 7. Results for the Sixth Problem Case

Groups	Test	N	$\bar{X}$	Sd	Df	t	p
Science attitude	Control Pre-test	27	76.85	7.22	52	-6.696	.000
	Control Post-test	27	90.07	7.28			

There is a significant difference in science attitudes between the pre-test and post-test results of the students in the control group [t (52) = -6.696, p=0.000]. However, this difference is a lower one than the experimental group.

Table 8. Results for the Seventh Problem Case

Groups	Test	N	$\bar{X}$	Sd	Df	t	p
Science attitude	Experiment Post-test	27	99.92	7.95	52	-4.747	.000
	Control Post-test	27	90.07	7.28			

Table 8 draws attention to the significant difference in post-test results between the experimental and control groups in science attitudes [t (52) = -4.747, p=0.000] in favor of the experimental group. This difference stresses that the experimental group's students have higher averages.

Table 9. Results for the Eighth Problem Case

Test	N	r	p
21st-Century Skill Science attitude	.54	.519	.000

When looking at Table 9, it was discovered that the post-test results of secondary school 7th-grade students and their 21st-century skills and science attitudes have a significant and positive correlation at the r=0.519, p=0.000 level. This situation punctuates that students' 21^{st}-century skills positively impact their views towards science.

CONCLUSION and DISCUSSION

In recent years, students have been taught scientific concepts through context-based teaching scope and examples supported by daily life. In this context, the aim is to improve students' scientific process skills while increasing their success rates and interest in learning (Bennett & Lubben, 2006; Gül, 2016; Kang et al., 2019; Yu et al., 2015). A fair number of studies regarding the positive effect of the context-based REACT model on students' attitudes and motivations are in the literature. In addition, some views, contrary to the constructivist approach-based teaching, argue that the program-oriented teaching method does not significantly affect attitudes (Ayaz & Şekerci, 2015; Ultay, 2017; Ünal & Çelikkaya, 2009). As a result, it can be claimed that REACT-based teaching, as being student-centric and design-based, positively affects students' attitudes, academic achievements, and motivations toward science classes.

Furthermore, having a positive impact on permanent learning, design-based or context-based teaching models are preferred nowadays instead of traditional modes of teaching. Although context-based approach problems require more analysis skills than traditional problems, materials prepared with this model escalate students' conceptual success and contribute to their active learning (Tekbıyık & Akdeniz, 2010). For this reason, REACT applications can and should be integrated into the curricula, and the development of student skills can be determined through questioning. One example supporting this view is the concept of "transferring", which is one of the context-based learning components, helps perceive phenomena in daily life using mind maps or concept maps. The concept development and "transferring" may provide more insights into how easy it is to teach science and how context-based approaches (REACT) can come into play in this circumstance.

The literature review ascertained that the context-based approach improved students' academic successes and contributed to the long-term learning of subjects. In the studies examined, the pattern depicting the context-based method positively affects motivation towards classes. According to many researchers, the reason for that, students develop course attitudes in a long time. Research also shows that students are more attracted by classes having context-based activities (Tatlı & Bilir, 2019).

It is claimed that context-based approaches, which are accepted as an essential development in Science Curriculum, address five main problems in science teaching. These are curricular overload with concepts which makes it hard for students to perceive the nature of science and the science itself (Millar & Osborne, 2010); the inconsistency of the curriculum itself due to some concepts it contains; the inability of students to transfer their achievements or the knowledge they have gained to other situations; the fact that the most of the lessons taught is not suitable for daily use and the lack of idea of students about why they should learn science (Laugksch, 2000). These problems must inevitably be solved. Otherwise, students' interest in science will diminish (Osborne & Dillon, 2008; Sjoberg & Schreiner, 2005). What is more, students' interest may continue to decrease in the science classes they would take in upper grades and the scientific studies they would do in the future (Gilbert et al., 2011).

Students can correctly answer concept questions with a bit of recall. Because short-term learning is likely to occur, in such a case, these concepts will probably be forgotten after some time. A study conducted by Karslı and Yiğit (2016) proved that newly learnt concepts are not forgotten after a month, and the information is permanent. The newly learnt knowledge may be more dominant for individuals than their initial alternative concepts. This situation can be interpreted as realizing permanent learning thanks to the information given through context-based teaching by relating it to real life. (Gül, 2016). By applying the REACT model to other science subjects where students try to 'memorize', the effects of the practices carried out within the scope of the REACT strategy of the context-based learning model on permanent learning can be investigated.

Creative thinking education is accepted as one of the most important goals of the science education program about academic success and student motivation (Tariq & Saeed, 2021). For this reason, utmost care is given to the content and structure of the science course and the approaches of teachers. Moreover, creative scientific thinking has a crucial role in human development and learning. Going on globalization and following up on technological trends to make life easier would only be possible with people who have innovative and creative thinking mindsets (Aktamış & Ergin, 2008). Therefore, science education has the most significant stake in improving the quality of scientific thinking. Learning approaches greatly

According to the results obtained, it was confirmed that the context-based REACT model contributes to students' creative thinking skills and 21st-century skills. This result coincides with some similar studies in the literature (Gül, 2016; Karslı & Yiğit, 2016; Ultay & Alev, 2017). Furthermore, the data collection tools used in the study verify the positive effect of the REACT strategy on students' science attitudes and learning retention. Consequently, similar findings obtained from this study and the literature are critical in determining the use of the REACT technique, affirming academic success, and encouraging its application in teaching science subjects or concepts.

Context-based learning improves students' thinking skills such as problem-solving, questioning and reasoning, and producing projects in a collaborative environment. In addition, concept and context discussions can shift students' perceptions of the subject and catch their attention. As a result, students can easily apply the knowledge and skills they acquire daily (Komalasari, 2016).

SUGGESTIONS

The context-based learning approach is a teaching system that claims learning can be achieved by linking the syllabus with students' daily lives and activities. Accordingly, learning activities should be carried out through contexts. There are specific features that the contexts used in the teaching process should have. These features should encourage students to learn and arouse their curiosity. Students who grow up with these learning approaches should conduct research and create links between the information they have just learnt and that they acquired in life. For sure, these contexts should be closely related to science, technology and the society in which students live.

Today, many teachers should use innovative strategies such as a context-based learning approach to increase, develop and direct their thinking skills (Kaya & Gül, 2021). Additionally, to develop 21st-century skills such as creative, critical, and innovative thinking, teachers and students should always use the thinking processes associated with these abilities during teaching and communication. In light of the literature review and results deducted in this research, it is advisable that REACT strategy is included in the science teaching program to equip students with desired skills and make learning permanent.

Experiments that develop hand skills are required to enable students to think and use their minds better (Aktamış & Ergin, 2008). In this context, various class materials can be prepared for students, appropriate to their levels, in the scope of STEM activities, one of the design-based teaching approaches, to improve their creative thinking and scientific process skills (Yilmaz & Yanarates, 2022). The effects of the REACT strategy can be examined at different grade levels as additions to context-based and similar experimental studies. In line with the findings of this study and the positive effects of the REACT model, the REACT model can be used to develop students' 21st-century skills and self-efficacy beliefs about the nature of science. The REACT model can also be used to increase students' individual success in science learning. REACT activities can develop students cognitively and affectively through sub-components of life skills. It is possible to investigate the effects of the REACT strategy on students' abilities in other skill areas using the findings of this study.

In sum, classes conducted under the context-based teaching model are more enjoyable. Furthermore, the studies conducted with a context-based approach (Karslı & Yiğit, 2016; Topuz et al., 2013; Yıldırım & Gültekin, 2017) reveal that the approach draws the attention of students powerfully. Subsequently, it is thought that the REACT model should be included in the science curriculum concerning both improving students' science attitudes and providing permanent learning.

ETHICAL TEXT

In this article, journal writing rules, publishing principles, research and publishing ethics rules, journal ethics rules are followed. Responsibility belongs to the author for any violations related to the article. Ethics committee approval of this article has been obtained with the meeting number 4 and also with the issue of 12/04/2022-61 in Kastamonu University.

Author contribution rate: The author's contribution to this study is 100%

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