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Abstract

As the use of artificial intelligence increases, its effects in many fields continue to multiply. One of the affected fields is science education. This study's purpose is to examine the effect of teaching the 'Electrical Circuit Elements' unit of the 5th grade science course with the REACT strategy integrated with artificial intelligence on the students' academic success. The study's research problem: "Does teaching the 5th grade unit of 'Electrical Circuit Elements' with REACT strategy integrated with artificial intelligence have an effect on pupils' academic success?" is as follows. In the study, a semi-experimental research design, which is one of the quantitative research methods, was used, pre- and post-tests were applied, and experimental and control groups were included. The study's participants were 37 students in the 5th grade of a secondary school in Türkiye. "Electrical Circuit Elements Academic Achievement Test" and students' applications related to ChatGPT were implemented as data collection tools in the study. In the experimental group, the REACT strategy integrated with artificial intelligence was used by preparing a lesson plan with ChatGPT for four weeks and getting help from ChatGPT during the lesson, while the 5E method was implemented in the control group. As a consequence of the research, it was detected that both approaches increased the students' academic success, but the REACT strategy integrated with artificial intelligence increased statistically significantly more than the 5E method.

Introduction

Today, the use of technology and innovative teaching methods in education is increasing. In this context, artificial intelligence tools have emerged as an important opportunity in education to enrich students' learning experiences and increase their level of understanding. This technology has the potential to revolutionize many aspects of education, such as answering specific questions, searching for information; participating in discussions and open conversations; writing and editing articles and reports; creating software codes; providing databases and data samples for analysis; teaching lessons by explaining codes; solving statistical analyses and mathematical calculations; and translating texts into other languages (Halaweh, 2023). Chat Generative Pretrained Transformer

(ChatGPT) is a remarkable state-of-the-art language model of artificial intelligence. ChatGPT allows users to get instant answers to their requests or questions (Jangjarat, et al., 2023). In particular, ChatGPT can be used to facilitate automated assessments and adaptive feedback, personalize educational experiences, engage students and increase engagement levels (Wang et al., 2023). However, ChatGPT can also facilitate discussion prompts, grammar and spelling corrections, lesson plans, curriculum and syllabus development processes (Hays et al., 2024). In addition, ChatGPT guides the learning process by interacting with students, providing them with information about scientific topics and answering their questions (Doğru, 2024). As this new technology is increasingly incorporated into students' daily academic practice, it becomes more urgent to empirically investigate its impact in the academic context and to uncover its benefits and limitations as perceived by stakeholders (Dai et al., 2023).

Looking at the research on ChatGPT, some studies provide insight into the benefits of using ChatGPT in the classroom. (Domenech, 2023), explain how it is used by students (Nughor et al., 2024), its potential use in education (Halaweh, 2023), the benefits and harms of its use (Vaughan et al., 2023), how it helps journal editors (Whang, 2024), experiences with teachers (Hays et al., 2024), its use in English language teaching (Mabuan, 2024). However, according to our current knowledge, there isn't any experimental study investigating to what extent the use of ChatGPT in any unit of science lesson affects the students' academic success.

There is a need for an innovative teaching method to experimentally investigate the effect of ChatGPT in the academic context related to the science lesson. In that context, it is thought that the REACT (relating, experiencing, applying, cooperating and transferring) strategy developed through the Occupational Research and Development's Center (CORD) will meet this need. Ingram (2003) based the REACT strategy on the constructivism approach in which students can construct concepts through various applications. In this context, this strategy is one of the classroom implementation strategies of context-based learning based on constructivist learning theory (Ültay et al., 2015). There are five steps in this strategy: relating, experiencing, applying, co-operation and finally transfer. While relating is the most vigorous contextual teaching strategy, it is also central to constructivism. Relating is defined as learning by establishing a relationship with a concept one knows; experiencing is defined as learning by doing through discovery and invention; applying is defined as learning by using concepts; cooperation is defined as learning by sharing and communicating with one's friends; and transferring is defined as using knowledge in a new situation (Crawford, 2001). According to Tuğcu (2023), with this strategy, the individual makes sense of his/her environment and the events around him/her, establishes a connection between his/her own experiences and the concepts and subjects in the science course, and can transfer his/her gains to different subjects. The use of lesson plans made according to the REACT strategy in the teaching process contributes to permanent and meaningful learning by establishing a connection between students' experiences and science concepts (Kaya, 2020).

Research on REACT strategy is increasing continually. When we look at the studies carried out, mostly different methods were compared with the REACT strategy (Gökalp and Adem, 2020; Güneş and Yılmazlar, 2024), students' motivation towards science courses (Keleş, 2019; Yıldırım, 2015), attitudes (Arıkan and Aladağ, 2021; Kaya, 2020). In addition, in some studies, the effect of REACT strategy on conceptual understanding (Abebe,

2023; Jelatu et al., 2018; Ültay, 2012), the competence of using it through experimental activities (Çelik et al., 2023), and its effect on reflective thinking (Aslangiray & Gezer, 2023) were also examined. However, according to our current knowledge, there isn't any study investigating to what extent the REACT strategy integrated with ChatGPT affects students' academic achievement. This article aims to contribute to the field by filling this gap. For this reason, it is estimated that it will be very valuable to investigate the impact of implementing the REACT strategy integrated with artificial intelligence by preparing a lesson plan with ChatGPT and getting help from ChatGPT during the lesson on students' academic achievement in teaching the 5th grade unit of "Electrical Circuit Elements".

Conceptional Framework

ChatGPT

Artificial intelligence (AI) is a field designed to enable computer systems to exhibit human-like abilities and intelligence. AI was first introduced by McCarthy et al. (1956) at the Dartmouth Conference. The chatbots developed by using deep learning and machine learning techniques of AI first started with the ELIZA programme by Weizenbaum (1966). This was followed by ALICE developed by Wallace in 1995 (da Silva et al., 2014). Afterwards, different programmes were also produced. In November 2022, OpenAI introduced ChatGPT, a chatbot that can use artificial intelligence to simulate human-like conversations (Jangjarat, et al., 2023).

ChatGPT is a conversational chatbot that can use a language model called Generative Pre-trained Transformer (GPT) to mimic human-like responses (Khosravi et al., 2023). GPT models are artificial neural networks that are pre-trained with large amounts of text data, and in the training process, the model uses a predetermined objective function to understand and learn word and sentence structures from a large language dataset and this learned knowledge can produce consistent, human-like responses to a variety of natural language prompts (Gamble et al., 2024).

ChatGPT is pre-trained to understand users' questions and produce logical answers. This is often implemented to raise the user experience in text-based chat applications or other interactive systems.

According to ChatGPT (2024), the main features of ChatGPT are as follows:

1. Natural language understanding (NLU): ChatGPT is an artificial intelligence model capable of understanding natural human language. It can read and understand text inputs and respond accordingly.
2. Text generation: ChatGPT can generate answers in natural language based on user questions and inputs. This allows for communication on a variety of topics.
3. Information on various topics: ChatGPT can have knowledge on various topics based on a huge knowledge base. However, the information is limited to real-time updates and therefore may not contain information about the latest updates.
4. Conversation flow and context: ChatGPT can understand the flow and context in a conversation. It can maintain a coherent conversation based on previous inputs.
5. Responsiveness and personalization: ChatGPT can be responsive to users' requests and emotional

- states. It can also be personalized to recognize specific personal preferences and characteristics.
6. Generativity and humor: ChatGPT can occasionally produce generative answers and has a sense of humor.
 7. Language diversity: ChatGPT can communicate in different languages. Text input can be received in multiple languages and processed accordingly.
 8. Comprehensive knowledge: It has wide knowledge base derived from educational data and can provide information on various topics.
 9. Suggestion and advice: Can make suggestions and recommendations on different topics.
 10. Productive writing: Can write productive texts such as stories, poems, scripts.

ChatGPT can be used both in applications that interact with users and in different areas such as designing and comprehending written texts, as well as in education. There are studies on ChatGPT in education. In the study implemented by Zhang et al. (2024) to investigate students' attitudes and behavioral intentions towards ChatGPT, no significant differences were found in ChatGPT behavioral intentions across genders or levels of ChatGPT usage experience. The study conducted by Mabuan (2024) to investigate English teachers' perceptions of using ChatGPT in English classes highlighted the importance of considering teachers' perceptions and experiences when integrating new technologies such as ChatGPT into English classes. In a study conducted by Davis (2024) to develop a course syllabus and lesson plans using ChatGPT, it was emphasised that AI lacks the ability to integrate previous lessons with current learning experiences or strategically prepare students for future learning outcomes. Adeleye and Ramnarain (2024) investigated science teachers' awareness of ChatGPT and inquiry-based learning and 5E model, and it was stated that teachers integrated ChatGPT into the inquiry-based learning 5E model. Alabidi et al. (2023) examined the effect of ChatGPT on assessment in science education. Cooper (2023) stated that ChatGPT is a useful tool that can be used in science education. Ng et al. (2024) stated that with the instructional design developed with ChatGPT in science education, learning anxiety decreased and learning performance, motivation and sustainable learning habits were supported.

REACT Strategy

REACT strategy is a strategy based on social constructivism and supported by context-based learning. According to Ültay and Çalık (2011), the use of the REACT strategy in lessons structures learning by enabling individuals to establish a relationship with life. There are five steps in the REACT strategy: relating, experiencing, applying, cooperating and transferring (Crawford, 2001). These steps provide a focus on learning and teaching with context, which is an important principle of constructivism (Jelatu et al., 2018).

In the relating step, the knowledge existing in the individual is associated with the contexts selected from daily life. In this section, associations can be made with a video, a reading passage, a case study, a story or a material. In the step called experiencing, there should be activities that allow individuals to concretize abstract concepts (Günter, 2018). In this section, worksheet, project, laboratory work, problem solving activities can be done. Thus, by pointing to learning in the context of discovery, invention and invention, students are enabled to experience activities directly related to real-life work (Ültay et al., 2015).

In the applying phase, students apply concepts using knowledge and concepts that are part of problem-solving activities (Deveci & Karteri, 2022). In this step, applications can be done through project, discussion, laboratory work, problem solving or question and answer activities. In the cooperating step, topics are discussed together in groups and topics are shared (Arıkan & Aladağ, 2021). In this step, project, performance homework, worksheet activities can be done with the group. The transferring phase is the phase where new information that has not been covered in the course before is used and students are given the opportunity to transfer the information they have learned to other areas and examples (Karlı & Yiğit, 2017).

In a study on REACT strategy in the field of education, Crawford (2001) found a positive effect on students' motivation and academic performance in his study on the use of REACT strategy in science and mathematics lessons. Ingram (2003) found that the use of REACT strategy as a teaching technique in chemistry courses increased students' attitudes towards science lessons. Çelik et al. (2023), in his study on the competence of using REACT strategy, found that the pre-service science teachers' ability to use REACT strategy increased as the number of activities increased. Aslangiray and Gezer (2023) found that in a course in which REACT strategy was used with reflective thinking activities; students were positively affected. Abebe et al. (2023) determined that REACT strategy facilitated students' conceptual understanding.

Current Work

This study's research problem: "Does teaching 5th grade 'Electrical Circuit Elements' unit with REACT strategy integrated with artificial intelligence have an effect on students' academic achievement?" is as follows.

Method

Research Design

In the study, a quasi-experimental research design with a control group in which pre and post-tests from quantitative research methods were used (Frankel & Wallen, 1996).

Participants

The study participants were 37 fifth-grade students studying at a public secondary school in Akyazı district, Sakarya Province, Türkiye. Since it is a school where boys study, all of the participants are male. Convenient sampling method was used for the participants' selection. With this method, the researcher is advantageous in terms of time. This is because the researcher prefers a sample that is close to accessible (Given, 2008). This sampling method was preferred because the first researcher was working in the related school. Since extreme values were identified during data analysis, the number of participants was reduced to 37. Demographic information of the participants can be found in Table 1.

Table 1. Participants' information

Group	Class	Number of students	Boy	Girl
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Experiment	5	21	21	-
Control	5	16	16	-

Data Collection Tools

In the study, 'Electrical Circuit Elements Academic Achievement Test (EDEABT)' prepared by Güven and Selvi (2021) was used to collect data. The average item difficulty of EDEABT, which is one of the data collection tools, was calculated as 0.637, the average item discrimination was 0.551, and the KR-20 value was 0.876. According to these data, EDEABT can be considered as medium difficulty, very good discriminative and quite reliable. There are 26 multiple-choice items in the EDEABT.

Implementation Process of the Research

The "Electrical Circuit Elements" unit was taught for four weeks with lesson plans for the REACT strategy integrated with ChatGPT in the group of experimental and with lesson plans prepared for the 5E method in the group of control. In the lessons given to the 16 students in the control group, activities designed according to the 5E method, a smart board and a textbook were used. In the lessons taught with 21 students in the experimental group, activities designed in accordance with the REACT strategy integrated with ChatGPT, textbook, ChatGPT and smart board were used. ChatGPT was used with a computer, mobile phone and smart board to be used on the teacher's desk to avoid disorder in the classroom. The information showing which features of ChatGPT were used in the lesson planning process and the stages of the REACT strategy are shown in Table 2.

Table 2. Phases of the REACT Strategy, Planning and ChatGPT Aids

	Planning	Relating	Experiencing	Applying	Cooperation	Transferring
Natural language understanding	√	√	√	√	√	√
Text production	√	√				
Information on various topics		√	√	√	√	√
Speech flow and context			√	√	√	√
Responsiveness and personalization						
Productivity and humour						
Language diversity						
Comprehensive information			√	√	√	√
Recommendation	√	√	√	√	√	√
Writing producer	√	√				

In the experimental group, students were informed about the REACT strategy and ChatGPT before the application started. Eight lesson hours were determined for the learning outcome "Shows the elements in an electrical circuit with symbols". Then, the lesson was started in accordance with the REACT strategy integrated with ChatGPT. In the association phase, the class was provided with "Ali's Electricity Adventure" prepared by ChatGPT by making use of the "generative writing" feature: "A Real Life Electric Circuits Story" prepared by ChatGPT was read. In addition, in order to attract the students' attention, an electrical circuit with LED lamps was brought with the suggestion of ChatGPT by using the "suggestion" feature. Then, the subject was explained. In the Experiencing step, students were allowed to make a simple electrical circuit using the related experiment report. In the Application step, students filled in the worksheet given to them. In the co-operation step, students established a simple electrical circuit by forming a group. In the transfer step, students were asked to construct simple electrical circuits with different numbers of circuit elements. Students received help from ChatGPT at any time at each stage. Some of the ChatGPT help received by the students in this process are given below:

Student: What is the switch' role in a simple electrical circuit?

ChatGPT: The task of the switch in a simple electrical circuit is to control the electric current in the circuit. By switching the circuit on or off, the switch allows electric current to flow in or out of the circuit. In this way, it allows or stops the electric current to flow at any time.

Student: In a simple electrical circuit, if the cable breaks, does the lamp light up?

ChatGPT: If a wire in an electrical circuit breaks and this wire cuts a connection point that will allow the lamp to light, the lamp will not light. When connections are cut in an electrical circuit, the circuit is broken and the electric current stops. Therefore, the lamp cannot be energized and will not light. However, if the broken cable is not between the lamp and the main source of electricity and the lamp can continue to work in one part of the circuit, the lamp may burn if other connections continue.

Eight lesson hours were allocated for the learning outcome "Predicts the variables affecting the brightness of a light bulb in an electrical circuit and tests his/her predictions". In the association phase, batteries and bulbs of different sizes and types were brought to the class with the recommendation of ChatGPT by using the "suggestion" feature. Three questions were asked to the class about them. After the answers, the subject was explained. In the experimentation step, students were allowed to make simple electrical circuits with different numbers of batteries or bulbs using the relevant experiment report. In the application step, students filled in the worksheet given to them. In the co-operation step, students formed groups and constructed simple electrical circuits with different numbers of batteries or light bulbs. In the transfer step, students were asked to answer the unit evaluation questions in the textbook. Students received help from ChatGPT at any time at each stage. Some of the ChatGPT help received by the students in this process are given below:

Student: What is an independent variable?

ChatGPT: An independent variable is a variable that is modified or controlled in an experiment or research. This variable, which the researcher actively changes during the experiment and calls the independent variable, is used to observe its effect on other factors. The change of the independent variable is important for analyzing the effects on the dependent variable.

Student: Can you give an example for the 5th grade "Electrical Circuit Elements" unit?

ChatGPT: "Number of batteries" can be used as an independent variable for the 5th grade electrical circuit elements unit.

Student: What is a dependent variable?

ChatGPT: The dependent variable is the variable that is observed and measured during an experiment or research. The dependent variable changes under the influence of the independent variable. In other words, changes in the dependent variable as a result of changing or manipulating the independent variable are analyzed. Therefore, the dependent variable represents the outcome or output of the experiment.

Data Analysis

To analyze the data obtained in this study, the SPSS (Statistical Package for the Social Sciences) 24 program was used. In the obtained data's statistical evaluation, the significance level was determined as 0.05. Firstly, the normality distribution of the data obtained was analysed by Shapiro-Wilk test (Büyüköztürk, 2007). Following the normality test performed for the pre-tests, an extreme value was detected. In the normality test performed after the extreme value was removed, it was understood that the data showed normal distribution. For this reason, inter-group comparisons were made with "independent (unrelated) samples t-test" and intra-group pre-posttest comparisons were made with dependent relations t-test.

Results

The results of the independent samples t-test conducted to determine whether the mean pre-test scores of students on the EDEABT differed significantly across groups are presented in Table 3.

Table 3. EDEABT Independent Samples t-test for Pretest Scores

Test	Group	N	Mean	Std. deviation	t	p
Pretest	Experimental	21	7.48	394.00	.028	.978
	Control	16	7.50	467.00		

Upon reviewing Table 3, it becomes evident that the pre-test scores of the two groups on the EDEABT don't show a statistically significant difference ($t = 0.028$; $p > 0.05$). This indicates that the readiness levels of both groups were determined to be comparable.

The results of the independent samples t-test conducted to determine whether the mean post-test scores of students on the EDEABT differed significantly across groups are presented in Table 4.

Table 4. EDEABT Independent Samples t-test for Posttest Scores

Test	Group	N	Mean	Std. deviation	t	p
Posttest	Experimental	21	16.29	3.538	3.885	.000
	Control	16	11.50	3.933		

Upon reviewing Table 4, it is clearly understood that the mean post-test scores of students in the two groups show a statistically significant difference in favor of the experimental group ($t = 3.885$; $p < 0.05$). Accordingly, it can

be concluded that after the intervention, the academic achievement of students in the experimental group in the fifth-grade unit "Electrical Circuit Components" was higher compared to those in the control group.

The results of the paired samples t-test conducted to determine whether the mean pre-test and post-test scores of students in the experimental group on the EDEABT differed significantly are presented in Table 5.

Table 5. Experimental Group Dependent Sample t-test for EDEABT Pre and Post-test

Test	Group	N	Mean	Std. deviation	t	df	p
Pre-posttest	Experimental	21	-8.952	3.514	-11.675	20	.000

Upon analyzing Table 5, it is evident that there is a statistically significant difference between the experimental group's pre-test and post-test mean scores ($t = -11.675$; $p < 0.05$). This indicates that the students' mean scores in the pre-test and post-test are not closely aligned.

The results of the paired samples t-test conducted to determine whether there is a statistically significant difference between the mean pre-test and post-test scores of students in the control group on the EDEABT are presented in Table 6.

Table 6. Control Group Dependent Sample t-test for EDEABT Pre and Post-test

Test	Group	N	Mean	Std. deviation	t	df	p
Pre and posttest	Control	16	-4.000	2.966	-5.394	15	.000

An analysis of Table 6 reveals a statistically significant difference between the mean pre-test and post-test scores of students in the control group ($t = -5.394$; $p < 0.05$).

Discussion

This study investigated the impact of implementing an AI-integrated REACT strategy on students' academic achievement in the specified unit. The pre-test results of the EDEABT indicated that the groups were similar before the intervention. In other words, the mean EDEABT scores of the groups did not show statistically significant differences. Following the confirmation of the groups' similarity, the intervention was carried out.

In the experimental group, lesson plans were developed according to the REACT strategy with the assistance of ChatGPT. In the implementation process, the stages of the REACT strategy were carefully applied. In the control group, lesson plans were prepared in accordance with the 5E method and the stages of the 5E method were carefully applied during the implementation. In the study conducted by Ültay and Çalık (2011), REACT strategy and 5E method were compared. In the study implemented by Keskin and Çam (2018), REACT strategy and constructivist approach were compared. Jelatu et al. (2018) compared GeoGebra supported REACT strategy with traditional teaching.

The EDEABT post-test mean scores of the experimental group showed a statistically significant difference. This difference shows that the students' academic achievement in the group of experimental was higher than the students in the group of control. In other words, using the REACT strategy integrated with artificial intelligence by preparing a lesson plan with ChatGPT and getting help from ChatGPT during the lesson in teaching the subject of electrical circuit elements contributed more to the academic achievement of the students compared to the 5E method. In the study implemented by Arslan (2023), it was determined that the REACT strategy supported by out-of-school learning environments increased students' academic achievement compared to the 5E method. In the study conducted by Artun (2023), it was determined that the academic achievement of the students was higher in the REACT strategy students in the post-test results and in the 5E model students in the retention test results. Considering the literature, the large number of studies that determine that the use of REACT strategy in lessons increases students' academic achievement supports the result of this study (Jelatu et al., 2018; Arıkan & Aladağ, 2023; Gökcalp & Adem, 2020). It is thought that the planning of the lesson with the help of ChatGPT, associating the topics with contexts from daily life, students' ability to apply the knowledge they have learned through individual and group work, transferring the knowledge they have learned to other fields, and getting help from ChatGPT when they need it contribute to this study's result. In this regard, Ültay et al. (2018) stated that teachers who prepared lesson plans in accordance with the REACT strategy compared to the 5E method were more successful because they made good context selection and designed different activities related to the selected context. Arslan (2023) stated that the most important reason why the REACT strategy is more effective than the 5E method is that the requirement of associating with daily life in the REACT strategy is not in the 5E method.

When analyzing the data obtained, it is clear that the students in the group of experimental presented a significant difference in the mean scores on the EDEABT pre- and post-tests. In other words, the students' mean scores in the group of experimental in the EDEABT pre-test and EDEABT post-test are not close to each other. This result shows that using the REACT strategy integrated with artificial intelligence by preparing a lesson plan with ChatGPT and getting help from ChatGPT during the lesson increases the students' academic achievement.

When the findings are analyzed, it is clearly understood that the students in the control group have a significant difference in the mean scores of the pre and post-test scores of EDEABT. In other words, the mean scores of the students in the control group in the EDEABT pre-test and EDEABT post-test are not close to each other. This result shows that using the 5E method in teaching the specified unit increases the academic achievement of the students.

Conclusion

In this study, it was found that preparing a lesson plan with the help of ChatGPT in the 5th grade "Electrical Circuit Elements" unit and teaching the lessons with the REACT strategy integrated with artificial intelligence increased students' academic achievement more than the 5E method. In addition, it was also determined that teaching the unit subject to the research to the students with the 5E method also increased the academic achievement of the students.

Recommendations

In this study, the effect of teaching the "Electrical Circuit Elements" unit with the REACT strategy integrated with ChatGPT on students' academic achievement was examined. In future studies, students' attitudes or motivations towards the course can be analyzed. The effect of integrating ChatGPT with another method on students' academic achievement can be investigated. Different subjects at the same grade level or subjects at different grade levels can be selected as research topics. A study can be conducted to take gender into account.

References

- Abebe, W. K., Tafari, H. W., & Faris, S. B. (2023). Effect of context based REACT strategy on students' conceptual understanding of heredity. *Cogent Education*, 11(1), 379-405. <http://doi.org/10.1080/2331186X.2023.2290104>
- Adeleye, V. O. & Ramnarain, U. (2024). Exploring the Integration of ChatGPT in Inquiry-based Learning: Teacher Perspectives. *International Journal of Technology in Education*. 7(2), 200-217. <https://doi.org/10.46328/ijte.638>
- Alabidi, S., AlArabi, K., Alsalhi, N. R. & al Mansoori, M. (2023). The dawn of ChatGPT: Transformation in science assessment. *Eurasian Journal of Educational Research*, 106, 321-337. <https://doi.org/10.14689/ejer.2023.106.019>
- Arıkan, A. & Aladağ, E. (2021). The effect of activities based on REACT strategy in social studies courses on students' academic achievement, attitudes towards social studies courses and on the retention of learning. *Eğitim ve Bilim Education and Science*, 46(206), 379-405. <http://dx.doi.org/10.15390/EB.2020.9028>
- Arslan, Ş. (2023). *The effect of context-based learning approach supported by out-of-school learning environments on academic achievement in the nature and chemistry unit*. Publication No.836464) [Master's thesis, Recep Tayyip Erdoğan University] Council of Higher Education Thesis Center.
- Artun, A. (2023). *REACT strategy of context-based learning and the effect of using the 5E model of constructive learning on the student's success and attitude to the course in social studies education*. Publication No.836229) [Master's thesis, Trabzon University] Council of Higher Education Thesis Center
- Aslangiray, H. & Gezer, S. U. (2023). Context-based learning supported by environmental measurement devices in science teacher education: A mixed method research. *Pamukkale University Journal of Education*, 57(1), 74-102. <https://doi.org/10.9779/pauefd.1017438>
- Büyüköztürk, Ş. (2007). *Handbook of Data Analysis for Social Sciences* (8. Edition). PEGEM Academy Publishing.
- ChatGPT (2024). *What are the main features of ChatGPT?* [Msg 1]. Message posted to <https://chatgpt.com/c/7ee38792-86c0-4528-a0eb-4ef0a07f4cc9>. Accessed 13 May 2024
- Cooper, G. (2023). Examining science education in ChatGPT: An exploratory study of generative artificial intelligence. *Journal of Science Education and Technology*, 32(3), 444-452. <https://doi.org/10.1007/s10956-023-10039-y>
- Crawford, M. L. (2001). *Teaching contextually: Research, rationale and techniques for improving student motivation and achievement in mathematics and science*. CCI Publishing, Waco-TEXAS.

- <https://www.collins-tips.com/distance-ed/crawford.pdf>
- Çelik, H., Pektaş, H. M., Karaşahin, A., & Karamustafaoğlu, O. (2023). Teacher candidates' proficiency in utilising the REACT strategy through experimental activities. *International Journal of Knowledge and Learning*, 16(1), 1-16. <https://doi.org/10.1504/IJKL.2023.127323>
- Da Silva, YA. S., Gao, X. Y., & Andrea, P. (2014, May 01). Wallace: Incorporating search into chatting[Conference session]. Australasian 13th *Pacific Rim International Conference on Artificial Intelligence* (PRICAI, Gold Coast, Australia.
- Dai, Y., Lai, S., Lim., C. P., & Liu, A. (2023). ChatGPT and its impact on research supervision: Insights from Australian postgraduate research students. *Australasian Journal of Educational Technology*, 39(4), 74-88. <https://doi.org/10.14742/ajet.8843>
- Davis, R. O. (2024). Prompt: ChatGPT, create my course, please!. *Education Sciences*, 14(1), 24. <https://doi.org/10.3390/educsci14010024>
- Doğru, M. S. (2024). The effect of the REACT strategy on students' achievements with regard to solubility equilibrium: using chemistry in contexts. *Chemistry Education Research and Practice*, 19(4), 1287-1306. <https://dergipark.gov.tr/ofed>
- Deveci, İ. & Karteri, İ. (2022). The effect of REACT strategy enriched with reflective thinking activities on students' reflective thinking. *Journal of Biological Education*, 56(5), 487-512. <https://doi.org/10.1080/00219266.2020.1821083>
- Domenech, Y. (2023). ChatGPT in the classroom: friend or foe? [Conference session]. *Ninth International Conference on Higher Education Advances*, València, Spain. <https://doi.org/10.995/HEAd23.2023.16179>
- Fraenkel, J. R. & Wallen, N. E. (1996). *How to design and evaluate research in education*. New York: McGraw-Hill
- Gamble, J. L., Ferguson, D., Yuen, J. & Sheikh, A. (2024). Limitations of GPT-3.5 and GPT-4 in applying fleischner society guidelines to incidental lung nodules. *Canadian Association of Radiologists Journal- Journal De L Association Canadienne Des Radiologistes*, 75(2), 412-416. <https://doi.org/10.1177/08465371231218250>
- Given, L.M. (2008) *The SAGE Encyclopedia of Qualitative Research Methods*, Vols. 1-0, SAGE Publications, Inc., Thousand Oaks, CA, <https://doi.org/10.4135/9781412963909>
- Gökalp, F. & Adem, S. (2020). The effect of REACT and computer-assisted instruction model in 5E on student achievement of the subject of acids, bases and salts. *Journal of Science Education and Technology*, 29(5), 658-665. <https://doi.org/10.1007/s10956-020-09844-6>
- Güneş, L. & Yılmazlar, M. (2024). Investigation of the effect of teaching the sixth class electricity transmission unit with REACT strategy on academic success of students. *International Journal of Educational Research Review*, 9(3), 184-202. <https://doi.org/10.24331/ijere.1459820>
- Günter, T. (2018). ChatGPT - Science education and instruction reshapes management. *Online Science Education Journal*, 8(1), 12-21. <https://doi.org/10.1039/c8rp00087e>
- Güven, Ç. & Selvi, M. (2021). Developing achievement test for 5th grade: Electrical Circuit Elements. *International Journal of Current Approaches in Language, Education and Social Sciences*, 3(1), 133-156. <https://doi.org/10.35452/caless.2021.7>

- Halaweh, M. (2023). ChatGPT in education: Strategies for responsible implementation. *Contemporary Educational Technology*, 15(2), 1-11. <https://doi.org/10.30935/cedtech/13036>
- Hays, L., Jurkowski, O. & Sims, S. K. (2024). ChatGPT in K-12 education. *TechTrends*, 68(2), 281-294. <https://doi.org/10.1007/s11528-023-00924-z>
- Ingram S. J., (2003). *The effects of contextual learning instruction on science achievement male and female tenth grade students*. PhD thesis, USA: University of South Alabama.
- Jangjarat, K., Kraiwanit, T., Limna., P., & Sonsuphap, R. (2023). Public perceptions towards ChatGPT as the Robo-Assistant. *Online Journal of Communication and Media Technologies*, 13(3), 1-14. <https://doi.org/10.30935/ojcm/13366>
- Jelatu, S., Sariyasa & Ardana, I. M. (2018). Effect of GeoGebra-aided REACT strategy on understanding of geometry concepts. *International Journal of Instruction*, 11(4), 325-336. <https://doi.org/10.12973/iji.2018.11421a>
- Karslı, F. & Yiğit, M. (2017). Effectiveness of the REACT strategy on 12th grade students' understanding of the alkenes concept. *Research in Science & Technological Education*, 35(3), 274–291, <https://doi.org/10.1080/02635143.2017.1295369>
- Kaya, S. (2020). *Teaching of 'digestive system' through REACT Strategy to 11th grade students*. PhD thesis. Atatürk University, Erzurum.
- Keleş, H. İ. (2019). *Teaching “pure substances, mixtures and the separation of mixtures” topics in the 7th grade science course through REACT strategy*. Master thesis. Kilis 7 December University, Kilis.
- Keskin, F., & Çam, A. (2018). The effectiveness of context-based REACT strategy on sixth grade students' academic achievement and scientific literacy. *Journal of Mehmet Akif Ersoy University Education Faculty*, 49(1), 38-59. <https://doi.org/10.1504/IJKL.2023.127323>
- Khosravi, T., Al Sudani, Z. M., & Oladnabi, M. (2023). To what extent does ChatGPT understand genetics? *Innovations in Education and Teaching International*, 1–10. <https://doi.org/10.1080/14703297.2023.2258842>
- Mabuan, R. A. (2024). ChatGPT and ELT: Exploring teachers' voices. *International Journal of Technology in Education*, 7(1), 128-153. <https://doi.org/10.46328/ijte.523>
- McCarthy, J., Minsky, M. L., Rochester, N. & Shannon, C. E. (1956). *A proposal for the Dartmouth Summer Research Project on Artificial Intelligence*. Dartmouth College, Hanover. <https://raysolomonoff.com/dartmouth/boxa/dart564props.pdf>
- Ng, D. T. K., Tan, C. W. & Leung, J. K. L. (2024). Empowering student self-regulated learning and science education through ChatGPT: A pioneering pilot study. *British Journal of Educational Technology*. <https://doi.org/10.1111/bjet.13454>
- Nugroho, A., Andriyanti, E., Widodo, P. & Mutiaraningrum, I. (2024). Students' appraisals post-ChatGPT use: Students' narrative after using ChatGPT for writing. *Innovations in Education and Teaching International*. <https://doi.org/10.1080/147003297.2024.2319184>
- Vaughan, G., Kovacs, A. & Szults, Z. (2023). ChatGPT in education: Strategies for responsible implementation. *Annales Mathematicae et Informaticae*, 58(1), 170-181. <https://doi.org/10.33039/ami.2023.11.001>
- Wang, X., Gong, Z., Wang, G., Jia, J., Xu, Y., Zhao, J., Fan, Q., Wu, S., Hu, W., & Li, X. (2023). ChatGPT performs on the Chinese national medical licensing examination. *Research Square*.

- <https://doi.org/10.21203/rs.3.rs-2584079/v1>
- Weizenbaum, J. (1966). Computational Linguistics. *Communications of the ACM*, 9(1), 36-45.
<https://doi.org/10.1145/365153.365168>
- Whang, Y. (2023). ChatGPT for editors: enhancing efficiency and effectiveness. *Science Editing*, 11(1), 84-90.
<https://doi.org/10.6087/kcse.332>
- Tuğcu, M. B. (2023). *The effect of teaching the subject of force, work and energy with react strategy on the academic achievement of 7 th grade students*. Master thesis Karamanoğlu Mehmetbey University, Karaman.
- Ültay, E. (2012). Implementing REACT strategy in a context-based physics class: Impulse and momentum example. *Energy Education Science and Technology Part B-Social and Educational Studies*, 4(1), 233-240.
- Ültay, N., Durukan, U. G., & Ültay, E. (2015). Evaluation of the effectiveness of conceptual change texts in the REACT strategy. *Chemistry Education Research and Practice*, 16(1), 22-38.
- Ültay, N. & Çalık, M. (2011). Distinguishing 5E model from REACT strategy: An example of ‘acids and bases’ topic. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education*, 5(2), 199-220. <https://dergipark.org.tr/tr/download/article-file/39836>
- Ültay, N. & Çalık, M. (2016). A comparison of different teaching designs of ‘acids and bases’ subject. *Eurasia Journal of Mathematics, Science & Technology Education*, 12(1), 57-86.
- Ültay, E., Ültay, N. & Dönmez Usta, N. (2018). Examination of the lesson plans according to the 5E learning model and REACT strategies for “Simple Electric Circuits” prepared by the classroom teacher candidates. *Kastamonu Education Journal*, 26(3), 855-864. <https://doi.org/10.24106/kefdergi.413382>
- Yıldırım, G. (2015). *Applications of context-based learning in primary 4th class science and technology course*. Master thesis. Anatolian University, Eskişehir.
- Zhang, Y., Yang, X. & Tong, W. (2024). University students’ attitudes toward ChatGPT profiles and their relation to ChatGPT intentions. *International Journal of Human-Computer Interactions*, 1-14.
<https://doi.org/10.1080/10447318.2024.2331882>

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