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Article

The effect of REACT model implementation on learning outcomes and critical thinking skills of students of SMAN 9 KENDARI

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Abstract: Quality human resources will be formed if education focuses on improving students' skills. Of course, the foundation of education must be quality. Qualified human resources will later be responsible for making Indonesia a good country in all fields. This study aims to examine the effect of applying the REACT learning model (Relating, Experiencing, Applying, Cooperating, Transferring) on learning outcomes and critical thinking skills of students of SMAN 9 KENDARI. Quantitative research method with experimental research type. The research design used was post experimental control design. The research location was at SMAN 9 KENDARI. The instruments used include learning outcomes test and critical thinking skills test. The data obtained were explained using statistical tests to see the differences between the experimental group and the control group in chemistry subjects. The results showed that the application of REACT model significantly improved students' learning outcomes and critical thinking skills compared to conventional learning methods in chemistry subjects. The findings indicated that the REACT model was effective in improving the quality of learning and developing critical thinking skills of students of SMAN 9 KENDARI, especially in chemistry learning.

Keywords: critical thinking ability; learning outcomes; REACT model; chemistry learning

1. Introduction

The progress of a nation and state system is greatly influenced by education. The journey of human life requires the main provision in the form of education. Therefore, education determines the progress of society (Ojuolape, 2024). Knowledge is gained through the learning process. Learning is an activity carried out which aims to gain knowledge, master skills and shape students' attitudes and personalities (Sihite et al., 2024). The smooth learning process will be successful if students feel motivated to learn, both motivation that comes from internal students and external. Education is considered successful as seen from changes in student behavior and academic achievement (Shum et al., 2024). Students who have received education are characterized by changes in attitude, understanding of knowledge, behavior, skills, habits and changes in various other aspects (Ningzi and Nurhayati, 2024). Education aims to create an atmosphere of learning activities that help learners actively develop abilities and skills so as to obtain religious spiritual stability, personality, self-control,

intelligence, noble moral beauty, and skills needed by themselves, society, nation and state. Education should be recognized since childhood and it is very important. The country must have good quality education in order to produce quality human resources as well (Hanif and Puspitarini, 2019). This globalization period requires students to have and master the skills needed in the 21st century, including: critical thinking, problem solving, creativity, collaborative and communicative (Mutohhari et al., 2021). Indonesia has made a lot of progress in the field of teaching in the following decades. However, the quality of teaching and learning outcomes have not progressed much. The quality of teaching in Indonesia is considered poor, with poor national exams, lack of offices, and various disciplinary issues (OECD, 2015). The clue to a country's instructive triumph is measured by students' success in various universal standardized tests. Therefore, Indonesia should still endeavor to improve the quality of teaching (Wijaya, 2019).

Based on information disseminated by the World Top 20 (2023). Indonesia is ranked 67th alongside Albania and Serbia in terms of teaching quality worldwide. Educational achievement in Indonesia in general is still slow and extraordinary consideration is needed to achieve the SDGs targets. The quality of teaching will largely depend on the quality of human resources. The quality of human resources will certainly be able to build a country that will eventually be able to prosper the people of Indonesia. Quality education will help the Indonesian nation and state to break even with its status in the eyes of other countries in the world so that Indonesia can be considered in the world arena. Achieving quality teaching requires coordination and participation between the government, the community, and the private sector to support each other in creating a comfortable and ideal learning environment (Abebe et al., 2024). All parties in teaching, including students, must have a strong mission and vision to clearly delineate the course of teaching by utilizing the assets available (Pramana et al., 2021). Education in Indonesia must continue to advance, by continuing to move forward in the existing education system to produce students who embrace the values of Pancasila and utilize technology to support the progress of the 5.0 era. Indonesia is modernizing and trying to prepare itself to become a developed nation by modernizing education without leaving the values contained in Pancasila (Prakoso et al., 2023).

Critical thinking skills are essential for individuals in the 21st century to survive and develop themselves and their businesses (Karakoç, 2016). Therefore, students must have the ability to think critically which is an advantage in solving life problems in the future. Learning methods that have long existed in Indonesia inhibit student activity. Teachers as educators must be able to design learning methods that can improve critical thinking skills so that students can actively develop their thinking potential (Maryani et al., 2021). Critical thinking literacy is not only the ability to think according to the rules of logic and probability, but also the ability to apply what is known and known in life without relying on what is available (Karakoc, 2016). Critical thinking skills aim to examine a point of view or idea by making judgments or thoughts based on the opinions and arguments put forward. Reflection is carried out responsibly in order to achieve the maximum possible results in learning activities. Critical thinking skills are refined through practical learning activities (Widyapuraya et al., 2023).

Thinking skills training must continue to be trained consistently through the selection of the application of effective learning models in accordance with the conditions and abilities of students (Putri et al., 2021). Mastery of critical thinking skills in students can develop students' cognitive, scientific, social, spiritual, and moral aspects. Mastery of critical thinking skills will influence students to learn better than students who do not apply critical thinking skills. There is a significant correlation between critical thinking skills and students' academic success (Mohamed and Mohammed, 2016). Therefore, a design is needed to create conducive learning conditions. In addition, students who have critical thinking skills can make decisions based on careful consideration so that problems can be solved more effectively and efficiently. The assessment of people who have critical thinking skills can be seen from the logic of the conclusions they draw (Purwaningsih and Wangid, 2021). The learning model that must be chosen is more directed towards student involvement in activities so that it can strengthen their critical thinking skills. Students who have critical thinking skills have the potential to have a bright future (Fitriani, 2022).

Bruner's Spiral Curriculum Theory emphasizes the importance of prior knowledge as a foundation for deeper and sustained learning. The REACT model integrates this principle through the "Relating", stage where the subject matter is linked to students' prior experiences, in keeping with Bruner's view of the importance of utilizing prior knowledge to build new understanding. The "Experiencing" stage in the REACT model supports Bruner's approach by encouraging active learning through the manipulation of real objects and phenomena, allowing students to gain understanding through direct experience. At the "Applying" stage, students apply concepts in new situations, which underlines the importance of repeated application of knowledge in various contexts, in accordance with Bruner's spiral principle of repetition and development of understanding. The "Cooperating" stage in the REACT model reflects the interactive aspect of Bruner's theory, where collaboration and discussion between students is used to enrich their understanding through the exchange of ideas and thoughts. This emphasizes the importance of social interaction in the learning process. Finally, the "Transferring" stage highlights the ability to transfer knowledge and skills to new contexts, which is central to the flexibility and adaptability emphasized in Bruner's spiral curriculum. Thus, the REACT model not only aligns with the basic principles of Bruner's Spiral Curriculum theory, but also strengthens and extends its practical application in the modern educational context.

Vygotsky's Sociocultural Theory emphasizes that learning occurs within an influential social and cultural context. The REACT model, through stages such as "Relating" and "Experiencing" connects learning materials to students' life experiences, allowing them to build deeper understanding within their social context. The "Applying" and "Cooperating" stages in the REACT model also support Vygotsky's Zone of Proximal Development (ZPD) concept, where social collaboration and guidance from others play an important role in students' cognitive development. The "Transferring" stage in this model highlights the importance of knowledge transfer through social interaction, reflecting the role of social mediation in learning according to Vygotsky. Thus, the REACT model not only applies the principles of Vygotsky's Sociocultural theory, but also amplifies its relevance and practical application in the modern educational context.

The REACT model offers a potential approach in honing essential 21st century skills in the context of global education (Li and Xue, 2023). Stages such as "Relating" and "Applying", students are not only directed to relate academic concepts to practical situations, but also to critically evaluate the relevance and application of these concepts in real life. The "Experiencing" and "Transferring" stages provide opportunities for students to develop their creativity by exploring different ideas and applying their knowledge in various contexts, which encourages them to find innovative solutions to complex problems. In the context of communication, the "Cooperating" stage in the REACT model develops students' collaborative skills through teamwork and in-depth discussions. This not only improves their ability to convey ideas clearly and persuasively, but also deepens their understanding of the values of cooperation in an increasingly connected global context. Developing skills that are not only relevant for current needs but also in preparation for an uncertain future, the REACT model goes beyond simply applying existing educational theories, but also integrates practices that promote critical thinking, creativity, effective communication and collaboration in a dynamic educational context.

An integrated analytical approach between quantitative and qualitative data is essential to understand the profound impact of the REACT model. The quantitative approach allowed for a systematic evaluation of the effectiveness of the model in improving students' academic achievement and critical thinking skills, with a focus on statistical analysis comparing results between the experimental group implementing the REACT model and the control group. In depth qualitative analysis provided a more detailed perspective on the contextual factors and mechanisms underlying these results. Through in-depth interview techniques and content analysis, the study was able to uncover students' and teachers' perceptions regarding their experiences with certain stages of the REACT model such as "Experiencing" and "Transferring". This enabled the identification of key elements that contributed to the improvement of students' understanding and critical thinking skills in greater depth.

This comprehensive approach not only aims to provide strong empirical evidence of the success of the REACT model in improving learning outcomes, but also to develop a more critical and contextualized understanding of the complex dynamics of learning in schools. This is important to support the development of a more adaptive and sustainable education in the face of increasingly complex educational challenges in the future.

The REACT model is a structured system for responding to critical situations with a systematic methodology (Anggiani et al., 2023). Consisting of five main components, the model requires organizations to quickly identify the problem, which is a crucial step in understanding the need for intervention. Evaluation is then the next focus, where the situation is thoroughly evaluated to assess its severity and impact on organizational goals. Action must be taken quickly and accurately based on an in-depth evaluation. Delays or confusion in responding can lead to escalation of the problem. Effective communication is key to ensuring that all concerned parties receive clear and timely information about the situation and actions taken. This involves using trusted communication systems and regular training to ensure effective coordination. Finally, tracking and evaluating the results of the actions taken is essential to ensure the effectiveness of the response and identify areas for improvement. Without an

effective tracking process, organizations will struggle to learn from experience and develop crisis response capacity. Overall, the REACT model demands managerial capability and organizational resilience in the face of critical challenges. Smart management of each component is key to maintaining an efficient response to emergencies and mitigating negative impacts.

The REACT strategy (Relate, Experience, Apply, Collaborate, and Transfer) is based on contextual learning that leads to student engagement in the classroom (CORD, 2012). The REACT model helps teachers and students make connections between concepts based on real life experiences. This situation encourages students' interest and motivation in learning. Learning begins with the teacher asking questions related to daily life with a context that can be related to learning. Activities in the laboratory by students can be used as a place to explore, discover and research. If there is a connection between the context and the concept, the technical aspect of the context is emphasized. Students can communicate with friends and share knowledge that has been learned and discussed in the learning process. Transfer refers to the application of knowledge in other conditions and situations (Crawford and ML, 2001). The REACT strategy used by teachers can improve the ability to represent various fields in learning, students will be actively involved in the learning process so that they can build knowledge (Mutohhari et al., 2021). In the learning process, students do not hesitate to ask about problems faced by teachers or friends. This participation plays an important role so that student problems can be resolved and overcome more quickly (Rosjanuardi and Sari, 2018).

The REACT model emphasizes students' freedom to find out the concepts of the material discussed in class based on various sources and references (Crawford-Aljabar and Majeed, 2022). The REACT model is very useful for improving various student skills such as critical thinking skills which have an impact on educational achievement, learning outcomes and student competencies (Putra et al., 2023). Another benefit of the REACT model is the improvement of physics learning performance and success (Rochana and Wulandari, 2022) increasing motivation to learn physics Newton's law (Ichsan et al., 2021). Higher Order Thinking Skill (HOTS), improved critical thinking skills and creativity (Herlina, 2022) mathematical problem-solving ability (Suraji et al., 2020) and mathematical communication ability (Suraji et al., 2020) and mathematical problem-solving ability (Musdi and Sastri, 2018).

The difficulty faced by students of SMAN 9 KENDARI 9 Kota Kendari is the large and dense learning material, where students are encouraged to learn by memorizing and counting out of context. Observations made at schools that implement the 2013 curriculum, teachers in saving time and accelerating learning use direct instruction methods and question practice systems. The direct instruction method makes learning teacher oriented where the teacher is the center of information. Meanwhile, the practice question method is implemented by asking students to answer the questions posed, mainly aimed at accelerating concept mastery. Students are only active in answering exercise questions given individually and discussing in groups. This condition causes students to lack motivation and enthusiasm in learning due to monotonous learning, students are not given the opportunity to link and connect learning materials with phenomena that occur in real life. Overcoming these problems can use the REACT strategy. Teacher learning emphasizes more on monotonous

activities and less optimal exercises and laboratories. One solution that can be done is to apply a more innovative learning model such as REACT. REACT oriented teaching and learning activities can affect student learning outcomes and abilities for the better. Learning that is always related to real life or hands on learning, makes students better understand the concept of learning material which they can then easily develop to solve the problems they face (Tyffani et al., 2018). Theoretically, the use of the REACT strategy in learning at school is able to train students. analyze real life phenomena so that it leaves long term memory after being studied (Widada et al., 2019). Theoretically, the use of the REACT strategy in learning at school is able to train students. analyze real life phenomena so that it leaves long term memory after being studied

This research could be substantially improved with some important additions that would enrich its content and make a more profound contribution to the educational literature (Seidel et al., 2017). Case studies illustrating the practical application of the REACT model in educational settings (Jarvenpaa and Leidner, 2023). The case study should include a description of the background of the school or classroom, including demographic information and student characteristics such as number of students, age, socioeconomic background, and academic level. These details are important to understand the context in which the REACT model was applied and to assess the link between student characteristics and the outcomes achieved (Heleni and Zulnaidi, 2021). The REACT model applied in teaching is indispensable. This includes the preparation stage, where teachers plan lessons using the REACT model by setting learning objectives, selecting the materials used, and determining the strategies chosen. The teaching process should also be described in detail, including the specific steps taken during the teaching process, the interactive methods used, the way students are divided into groups, and the learning activities designed to increase student engagement. The tools and resources used to support the implementation of the REACT model, such as textbooks, digital media, or practicum materials, should also be described.

The achieved results section should present qualitative and quantitative data on the outcomes following the application of the REACT model. This includes improvements in academic performance, which can be measured by grade data before and after the application of the model, as well as comparison with the control group if applicable. The development of critical thinking skills should also be measured through tests or other assessments before and after the implementation of the model. Challenges encountered during the implementation of the REACT model, such as resistance from students or time and resource constraints, should be identified and explained, along with strategies used to overcome these challenges, for example by adjusting teaching methods or using additional resources.

The reflection and practical implications section should include reflections from teachers and students on their experiences with the REACT model, as well as a discussion of the practical implications of these findings for future teaching. This includes recommendations for other educators who want to implement the REACT model in their classrooms. For example, a case study could illustrate the application of the REACT model in a SMAN 9 KENDARI in a big city, teachers applied this model in math lessons with the aim of improving concept understanding and critical

thinking skills. The implementation process involved using real problems relevant to students' daily lives to make learning more interesting and meaningful. Outcome data showed significant improvements in students' math test scores and critical thinking test scores. Challenges encountered included limited time to design relevant learning materials and initial resistance from students who were used to traditional teaching methods. These challenges were overcome by collaboration between teachers to share resources and experiences, as well as explaining to students the benefits of this new learning approach. The addition of a comprehensive case study such as this, the paper will provide a more concrete and applicable picture of the effectiveness of the REACT model in real situations, as well as offer useful insights for other educators who wish to adopt this model in their practice.

Critical aspects that need further consideration. One of them is the long-term effectiveness of the REACT model. Whether improvements in academic performance and critical thinking skills persist long after students leave the classroom environment using the REACT model. Longitudinal studies are needed to evaluate this long-term impact. In addition, it is necessary to investigate whether the REACT model can be effectively adapted in different subjects and different levels of education. While the case study may show success in mathematics lessons in high school, its effectiveness in other subjects such as language or science, as well as at lower or higher levels of education, needs to be further explored.

Another aspect that needs to be criticized is the suitability of the REACT model to various cultural and social contexts. A learning model that is effective in one cultural context may not be suitable in another. Further research should consider how the REACT model can be adapted to the needs and characteristics of diverse cultures. This includes considering cultural values, social norms and societal expectations of education. This research makes a stronger and more in-depth contribution to the educational literature, but it also provides valuable practical guidance for educators who want to adopt and implement the REACT model effectively in their teaching. The application aspect of the REACT model, this paper will pave the way for further research that can strengthen the evidence base on the effectiveness of this model and assist in the development of better teaching strategies in the future.

Improvements in academic grades or critical thinking skills, it is important to explore the factors that most contribute to such outcomes (Howard et al., 2020). This research requires a comprehensive comparison between the group that implemented the REACT model and the control group to validate the effectiveness of the model. A critical evaluation of challenges during implementation, such as student resistance and resource limitations, needs to be included with an analysis of the strategies used to overcome them. The reflection section should be in depth by describing the advantages and disadvantages of implementing the REACT model as well as offering concrete recommendations to improve future teaching practices. The evaluation of the REACT model should also highlight the effectiveness in various cultural and social contexts, considering cultural values and social norms. With this approach, this paper will make an important contribution to the educational literature and provide valuable practical guidance for educators.

2. Methodology

This study used a quasi-experimental design with pretest posttest control group design to test the effect of applying the REACT model (Relating, Experiencing, Applying, Cooperating, Transferring) on learning outcomes and students' critical thinking skills in chemistry subjects. The research was conducted at SMAN 9 KENDARI, located at Jl. P. Diponegoro No.108, Punggaloba, West Kendari District, Kendari City, Southeast Sulawesi, Indonesia, during the odd semester of the 2023/2024 academic year. The sample consisted of 60 grade XI students, with 30 students in the experimental group and 30 students in the control group. The research procedure involved preparations such as coordination with the school, preparation of a syllabus based on the REACT model, and teacher training. For 8 weeks, the experimental group was taught using the REACT model, while the control group used conventional methods according to Curriculum 2013. Pretest and posttest were conducted to measure learning outcomes and critical thinking skills. The instruments used included multiple choice tests for learning outcomes, essay tests for critical thinking skills, and observation sheets. Data were analyzed using the T Test with the help of SPSS software. This method is expected to provide an overview of the effect of the REACT model on student learning outcomes and critical thinking skills. The following is the conceptual framework of the research (**Figure 1**):

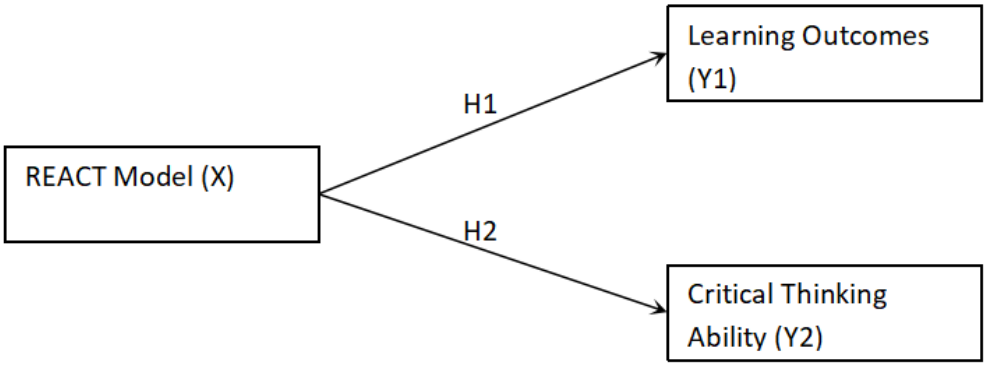

Figure 1. Conceptual Framework.

3. Results

3.1. Homogeneity test

The homogeneity test serves to show whether the data values collected do not differ significantly in variance. Determination of homogeneity or not a data appears from the sig value > 0.05 means that the data is homogeneous or has the same variance. Then on the contrary, if the data has a levene statistical sig value < 0.05, it means that the data is not homogeneous and there are different variations between the data (Setyawarno, 2017). This study used the Levene test to determine the normality of the data. This study used the Levene test to determine the normality of the data listed in **Table 1**.

Table 1. Homogeneity of variance.

Levene statistics	df1	df2	Signature
0.527	3	108	0.665

Sumber: Data Olahan, 2023.

Testing with homogeneity of variances determines the homogeneity of a data set determined from the sig value > 0.05. Testing with homogeneity of variances shows a significance value in **Table 1** of 0.665 > 0.05. This means that the data collected from the experimental class and control class have a homogeneous distribution.

3.2. Normality test

Testing can continue if the data collected is normally distributed. Generally, normality testing uses non parametric statistical analysis with one sample Kolmogorov Smirnov. Testing with kolmogorov sminorv is declared normally distributed if it has an Asymp.sig value > 0.05 and vice versa. **Table 2** lists the results of the normality test of the data collected including learning outcomes and critical thinking skills.

Table 2. Normality test results.

	Class	Information	Non standardized Residue
Learning outcomes	Control Class	N	30
		Kolmogorov Smirnov	0.138
		Asymp. Signature (2 tails)	0.153
	Experimental Class	N	30
		Kolmogorov Smirnov	0.141
		Asymp. Signature (2 tails)	0.129
Critical Thinking Ability (CTA)	Control Class	N	30
		Kolmogorov Smirnov	0.148
		Asymp. Signature (2 tails)	0.090
	Experimental Class	N	30
		Kolmogorov Smirnov	0.135
		Asymp. Signature (2 tails)	0.168

Source: Processed Data, 2023.

Checking the reasonableness of information is often based on the Kolmogorov Smirnov test, which appears from the Asymp. Sig (2 tailed) value. The Asymp. Sig value of the learning outcome information collected in the control study was Asymp. Sig 0.153 > 0.05, while asymptotically. Sig value of the test lesson is known in **Table 2** as 0.129 > 0.05. Appreciation of the surrounding environment. Sig values that are greater than 0.05 for the learning that occurred in the control and experimental classes, make it clear that the data collected has a typical distribution. Baseline information to assess the basic thinking ability of students of SMAN 9 KENDARI was also collected in the control and exploratory classes. Tests using Respond showed the basic thinking ability of students of SMAN 9 KENDARI all scored up to Asymp. signature award. 0.168 > 0.05 in the test lesson. The basic reasoning ability of the control class made a

difference when Asymp. Correct. 0.90 > 0.05. This can be seen from the information regarding the basic thinking aptitude of students of SMAN 9 KENDARI, which is generally scattered. Such information can be utilized to assist testing in the autonomous T Test.

3.3. Independent Sample T Test

The description of the data collected includes the number of respondents, mean, standard deviation and standard error of mean. **Table 3** shows the results of the Independent Sample T Test in the form of descriptive statistics of each group as well as learning outcomes and critical thinking skills.

Table 3. Group statistics.

Variables	Class	N	Means	Std. Deviation	Std. Deviation
Learning outcomes	Experiment	30	82.03	6.931	1.265
	Control	30	61.23	8.904	1.626
Critical Thinking Ability	Experiment	30	76.37	15.196	2.774
	Control	30	54.00	9.903	1.808

Source: Processed Data, 2023.

The exploratory and control courses had 30 students. The normal scores of learning outcomes and basic thinking skills in the control lesson were lower than in the exploratory lesson. The normal value of learning outcomes in the control lesson was 61.23, while the normal value in the test lesson was 82.03. Explorative learning calculates the resulting learning with a standard deviation value of 6.931. The standard deviation of the control course was 8.904. The normal value of basic thinking ability in the control subject was 54.00, while the normal value in the test subject was 76.37. The basic reasoning capacity information of the exploration class was calculated to have a standard deviation value of 15.196. The standard deviation of the control lane is 9.903.

4. Discussion

H $_1$: REACT Model Significantly Affects Learning Outcomes

Linear regression analysis The T Test serves to see the magnitude of the influence exerted by the independent variable individually or partially on the dependent variable (Wardani et al., 2022). Hypothesis acceptance is known through the T_{table} value and significance. H0 is accepted if $T_{count} > T_{table}$ or $T_{count} < T_{table}$, while Ha is accepted if $T_{count} < T_{table}$ or $T_{count} > T_{table}$. Determination of the hypothesis conclusion is seen from the significance value and the regression constant value. Ha is accepted if sig < 0.05 and $\beta x > 0$ (positive influence) and $\beta x \leq 0$ (negative influence). **Table 4** displays the results of the Independent Sample T Test test of the effect of applying the REACT learning model on learning outcomes, especially in chemistry subjects.

Homogeneity testing can use Levene's which is listed in **Table 4** in the Levene's Test section for equality of variances. Based on **Table 4**, it is known that the sig. levene's test value is 0.128 > 0.05. This value indicates that the data is homogeneous and can continue to see the T Test. Based on the table, the calculated T_{value} is 10.097 >

T_{Table} 2.051 and sig. (2 tailed) 0.000 < 0.05 and, it means that there is a significant difference in the value of the experimental class and control class between students of SMAN 9 KENDARI. It can be seen that the average learning outcomes of SMAN 9 KENDARI students in the experimental and control classes are significantly different. Therefore, the REACT learning model has an impact on student learning outcomes (Abebe, 2024). Learning with the REACT model encourages students to master the basic concepts of learning materials (Gökçe et al., 2024). Mastery of the concept of learning materials makes it easier for students of SMAN 9 KENDARI Kota Kendari to develop these concepts to solve problems posed by teachers in order to improve student learning scores. The high scores achieved by students indicate the level of mastery of learning materials of SMAN 9 KENDARI students, meaning that they obtain optimal learning outcomes.

An effective strategy to improve students' academic achievement is by applying the REACT learning model (Quainoo et al., 2021). REACT model is more effective to improve students' academic achievement (Rahmawati, 2024). The gap between the high achieving group and the low achieving group is not bridged by the REACT model. The difference may arise due to the different construction styles of each student. Students have the ability to discover and share information with their peers as well as their newly learned concepts that they can connect, all through the REACT model. The REACT learning environment increases students' motivation and interest to learn more about the concept learning material. The involvement of students and teachers in REACT makes students want to learn even though it takes a long time to complete the material (Knoef et al., 2024).

REACT model can significantly affect the learning outcomes of students of SMAN 9 KENDARI. The application of REACT model in learning at SMAN 9 KENDARI makes students very enthusiastic to actively participate in learning. Active participation of students who help each other in finding concepts and applying them in daily life is often called conceptualization. The REACT learning model encourages students to be more active in learning so that students become easier to understand the concepts of learning materials (Saragih and Sitorus, 2023). The utilization of the REACT model in teaching and learning activities encourages students to obtain maximum learning outcomes (Bachtiar et al., 2023). Practice of the REACT learning model in teaching and learning activities that present common phenomena and are very easily encountered by students (Kastina and Sola, 2022).

High school students successfully develop information in learning materials from query exercises (Ismeini et al., 2024). The magic of lifestyle issues makes the concepts students learn more meaningful (Mohd and Ojuolape, 2024). Exams conducted by students provide assistance to students to uncover problems and increase students' science knowledge. Expanded student information will result in students being more capable in learning so that student learning achievement will increase. Learning shows where students effectively summarize concepts and explanations in a straightforward manner so that they are easy to remember. Concept understanding affects student learning achievement where student learning outcomes will improve. The continuity of the connected learning event can be seen from students' learning outcomes, in terms of information and students' reactions (Jannah and Suparidi, 2020).

Table 4. Independent sample T test learning outcomes.

Infromation		Levene's Test for Equality of Variances		T Test for Equality of Means						
		F	Signature	T	df	Signature (2 tails)	Significant Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Above
Learning outcomes	Equal variance is assumed	2.385	0.128	10.097	58	0.000	20.800	2.060	16.676	24.924
	Equal variances are not assumed			10.097	54.703	0.000	20.800	2.060	16.671	24.929

Source: Processed Data, 2023.

H_2: REACT Model Significantly Affects Critical Thinking Ability

Based on **Table 5**, the calculated T_{value} is 6.754 > T_{Table} 2.051 and sig. (2 tailed) 0.000 < 0.05, meaning that there is a significant difference in the value of the experimental class and control class at SMAN 9 KENDARI. It is stated that the average value of thinking ability of SMAN 9 KENDARI students in the experimental class and control class is significantly different. Therefore, there is an effect of REACT learning model on the thinking ability of students of SMAN 9 KENDARI especially in chemistry subject. Putra et al. (2023) effectively apply the REACT model as a teacher strategy to instill and develop students' thinking skills (Putra et al., 2023). The REACT learning model encourages students to actively participate in contributing to the teaching and learning process so that students become more creative in finding solutions to solve the problems they face (Wang et al., 2024). The REACT learning model helps students gain practical learning experience because learning activities with the REACT model provide opportunities for students of SMAN 9 KENDARI to connect concepts in learning materials with phenomena that occur in real life, seek and gather information about learning materials in daily life and practice (Redhana et al., 2024). This learning concept can help students of SMAN 9 KENDARI to get used to thinking critically not only in school but also in society. This learning concept can help students of SMAN 9 KENDARI to get used to continue thinking critically not only at school but also in the community. The application of this activity to student learning at school can improve the critical thinking skills of students at SMAN 9 KENDARI especially in chemistry subjects.

The REACT model provides facilities for students to explore their potential in developing critical thinking skills (Muhammad, HA, and Muhammad, 2016). The benefits that can be felt directly by students are the improvement of student learning outcomes and techniques used in interacting in solving problems faced, therefore it is important to instill critical thinking skills. Students obtained higher science scores when learning with the REACT strategy (Farida et al., 2023). There are many positive impacts that students receive through learning with the REACT model, some of which include knowledge and mastery of material and critical thinking skills (Li, 2023). The contextualization based REACT method approach that makes students have to connect the knowledge gained with phenomena in the real world. Direct experience makes learning more fun, students feel excited and motivated, and students are able to

independently understand the problems in the learning process so that the learning objectives expected by the teacher are achieved (Anggiani et al., 2023).

Table 5. Independent sample T test of critical thinking ability.

		Levene's Test for Equality of Variances		T Test for Equality of Means						
		F	Signature	T	df	Signature (2 tails)	Significant Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Above
Critical Thinking Ability	Equal variance is assumed	7.149	0.010	6.754	58	0.000	22.367	3.312	15.738	28.996
	Equal variances are not assumed			6.754	49.868	0.000	22.367	3.312	15.715	29.019

Source: Processed Data, 2023.

5. Conclusion

The application of REACT (Relating, Experiencing, Applying, Cooperating, Transferring) learning model to learning outcomes and critical thinking skills of students of SMAN 9 KENDARI Negeri 9 Kendari in chemistry subject significantly improves learning outcomes and critical thinking skills of students. Students who learn by using the REACT model show a deeper understanding of the chemistry material and are able to connect the concepts learned with real situations. In addition, active involvement in the learning process through direct experience and cooperation with classmates strengthens students' critical thinking skills. The results of this study provide important applies for educators, especially chemistry teachers at SMAN 9 KENDARI. The application of the REACT learning model can be used as an effective alternative strategy for improving the quality of learning and driving the development of students' critical thinking skills. By using this approach, teachers can create a more interactive and contextualized learning environment, so that students are more motivated to learn and are able to understand the material more deeply. In addition, education policy at the school level can consider the REACT learning integration model in the curriculum to achieve more optimal learning outcomes (Prakosom et al., 2023). This implication also underlines the importance of training and professional development for teachers so that they are ready to implement innovative learning models such as REACT in their daily learning process.

6. Recomendation

Based on the findings in the article "The Effect of REACT Model Application on Learning Outcomes and Critical Thinking Ability of Students of SMAN 9 KENDARI", there are several suggestions that can be applied for further development and application of REACT model in education. First, teachers need to receive comprehensive and continuous training on the application of the REACT model, which includes an in depth understanding of the theory, practical strategies, and effective evaluation techniques. Second, the curriculum should be designed in such a way that it allows the application of the five components of REACT (Relating, Experiencing, Applying, Cooperating, Transferring) in each subject, so that students

can connect concepts with real experiences, increase engagement, and develop critical thinking skills. Third, teachers are advised to apply active learning methods such as collaborative projects, hands on experiments, case studies, and group discussions to help students better understand the material, improve critical thinking skills, and achieve better learning outcomes. Fourth, it is important to conduct periodic evaluations of the implementation of the REACT model and provide constructive feedback to teachers and students to identify areas that require improvement and ensure the REACT model is implemented effectively. Fifth, schools should provide adequate facilities and resources, such as laboratories, teaching aids, technological devices, and interactive learning materials to create a conducive learning environment. Sixth, collaboration with parents is essential, by providing information about the concept and benefits of the REACT model so that they can support children in connecting learning at school with everyday life. Finally, further research is needed to continue evaluating and developing the REACT model, including longitudinal studies to evaluate the long-term impact of this model on students' critical thinking skills and learning outcomes.

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