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Analysis of Students' Creative Thinking Skill Achievement through the Implementation of the C-R-E-A-T-E Learning Model on the Natural Acid-Base Lesson

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ABSTRACT

This research is motivated by the fact that the creative thinking skills possessed by students in Indonesia as a whole are still of concern. The purpose of this research is to obtain information about the achievement of creative thinking skills through the Connecting - Restructuring - Elaborating - Applying - Tasking (C-R-E-A-T-E) model of learning on the lesson of natural acid-base indicators for class XI senior high school (SMA) students. The method used is descriptive. The research participants were 20 students and 3 observers. The instruments used were Structured Task Sheets (LTT) and observations of the achievement of creative thinking skills. The data obtained from the research instruments were scored, presented as percentages and categorized to obtain an overview of the achievement of creative thinking skills. The results of the research showed that overall the achievement of creative thinking skills was through application. The C-R-E-A-T-E learning model has a good but fluctuating category. The highest skill in creativity was achieved at the Applying stage in the very good category. It is recommended that the use of the C-R-E-A-T-E model of learning to achieve creative thinking skills be applied to other chemistry lessons as well.

1. Introduction

The century of the industrial revolution 4.0 or often referred to as the century of knowledge is the 21st century. In this century there are changes in various fields. One of them is the field of education. In this century information becomes unlimited and very fast because technology and science are developing increasingly advanced. This affects students in the education process in Indonesia. In this situation, students are required to have various abilities that students must have. The demands of 21st century learning are 4C skills, namely communication, collaboration, creativity and innovation, and critical thinking skills and problem

solving (Irwanto, 2023). Thus, teachers as educators are required to be able to design learning that allows students to achieve these four 21st century skills.

Until now, research on creativity is still the focus of research in education. According to Redhana (2019), it is very important to develop students' creativity, because creativity is one of the most important factors in lifelong learning and students' future success. In addition, according to Lubis (2018), creativity has a big influence and contributes to a person's life, for example in academic achievement. So, the higher the creativity a person has, the higher the academic achievement he achieves (Azzahra, 2023). In addition, the importance of creativity according to Williams states that individuals who have creativity can realize themselves (Khaerunnisah, 2023), have the ability to find new ways to solve a problem (Mardhiyah, 2021), provide satisfaction, improve the quality and standard of living, are encouraged to make ideas, and discoveries or new technologies that can improve the welfare of society at large. From several studies on creativity, it shows that creativity is a very important thing to build, because creativity is important in a person's life (Trilling, 2009).

The right learning model is one of the components that take part in achieving the success of teaching and learning activities. An important role in determining the right learning model lies with the educator. Educators have a very important role in determining the quality and quantity of teaching they carry out. Therefore, educators must think and plan carefully in improving the quality of their teaching. This requires changes in classroom organization, the use of teaching methods, developing good learning materials, the use of appropriate teaching media in order to achieve the goals to be achieved in the learning process (Purwanto, 2006).

C-R-E-A-T-E as a project-based model has several characteristics, which are as follows: (1) Focus on problems for mastery of important concepts in learning; (2) Project creation involves students In conducting constructive investigations; (3) Projects must be realistic; (4) Projects are planned by students (Wahyu, 2019). The directions and systematics in the C-R-E-A-T-E learning model sequentially starting from the stages of connecting thoughts with facts (Connecting), building knowledge (Restructuring), elaborating (Elaborating), applying (Applying), giving project tasks (Tasking), and making decisions based on evaluation results (Evaluating) are organized and appropriate for developing project-based creativity. The C-R-E-A-T-E model is very well applied because it produces project-based products that are contextual and based on real life, making it easier for students to complete and achieve learning objectives through the given project and obtain meaningful learning. The project given certainly has the potential to hone students' creativity skills. With these various considerations, the author chose the C-R-E-A-T-E learning model as the recommended learning model to be applied so that students have creativity skills (Wahyu, 2020).

In this research, the lesson raised by the author is natural acid-base indicators. Natural acid-base indicators are one of the concepts in chemistry that is contextual in nature (Sari, 2022). The lesson of acid-base indicators was chosen because it includes the concepts of theory and practice (Mulyasa, 2023). In addition, the lesson

of natural acid-base indicators requires not only mastery of concepts in the form of knowledge but also how to connect existing concepts so that students' knowledge is comprehensive and meaningful (Andani, 2021). Natural acid base indicators are well suited because they allow students to engage in hands-on exploration from extracting materials to testing color changes and analyzing results in a creative and independent manner (Muna, 2021). Not only that, this lesson is also considered by the author to be a lesson that can be adapted to the learning stages of the model that the author researched, namely C-R-E-A-T-E. This study aims to prove that creativity skills can be achieved through learning the C-R-E-A-T-E model on the lesson of natural acid-base indicators. The expected results of the research is that overall the achievement of creativity skills was through application.

2. Methodology

This research was conducted in one of the public high schools in Cimahi City. The participants involved for this research were lecturers, teachers, peers and students. The internal feasibility test was conducted by feasibility examiners, namely two lecturers of Chemistry Study Program FPMIPA UPI and three senior high school chemistry teachers. In the external observation, peers involved 3 observers who understood the lesson and also the model used in the research. The external feasibility test was conducted on 20 students of class XI IPA in one of the public high schools in Cimahi city who had not studied the lesson of natural acid-base indicators. This research was conducted in the even semester of June 2024.

The method used in this research is a descriptive qualitative method, which aims to construct a systematic, factual, and accurate description of the facts, characteristics, and relationships among the phenomena investigated (Sugiyono, 2013). Through this approach, the researcher observes, documents, and interprets the learning process as it naturally occurs in the classroom. In this study, the author analyzes students' creativity skills at each syntax of the C-R-E-A-T-E model to provide a clear picture of how the model operates in practice. This analysis is intended to show readers the extent to which the C-R-E-A-T-E learning model is feasible and effective for supporting the development of creativity skills, particularly within the context of learning natural acid-base indicators. By examining creativity indicators across all stages, the study offers a comprehensive understanding of how structured activities within the model can engage students in creative thinking processes.

This study adapts the indicators of creativity skills proposed by Williams (1968), which consist of four core components: (1) fluency, (2) flexibility, (3) originality, and (4) elaboration. These indicators serve as the foundation for analyzing how students demonstrate creative thinking during the learning process. Each indicator was further developed and adjusted by the author to align with the characteristics of the lesson implemented in this research, namely the natural acid-base indicator topic for eleventh-grade high school students. The adaptation process included refining the sub-indicators so they would be relevant to the experimental, inquiry-based, and product-oriented nature of the C-R-E-A-T-E learning model. By contextualizing the indicators to the specific learning content and activities, the

study ensures that the evaluation of creativity skills reflects students' real experiences and performances during the lesson. Table 1 presents the complete set of indicators and sub-indicators applied in this study.

Table 1. Indicators of creativity Williams

Indicators	Sub-Indicators
Fluency	- Answers acid-base indicator questions with a number of answers orally or in writing - Express many ideas fluently
Flexibility	Has a variety of ideas in determining materials for creative work on natural acid-base indicators Provide interpretation of images/video or narration of questions in structured assignment sheet of natural acid-base indicators Identify the products of an organizing process, plan with examples
Originality	Making modifications to the creative work of natural acid-base indicators Choosing other ways in making creative works of natural acid-base indicators
Elaboration	Develop or enrich the ideas contained in the structured assignment sheet Make creative work more interesting

The data consisted of scores obtained from observation instruments completed by the observer throughout the implementation of the C-R-E-A-T-E learning model. These observation sheets captured student behaviors, actions, and responses that reflected the development of creativity skills at each stage of the model. Using basic content-analysis techniques, the raw scores were systematically organized and then converted into percentage values for each learning syntax to provide a clearer representation of students' performance (Plomp, 2007). After converting the data, the total scores for each indicator were calculated and compared with the maximum possible score to determine the level of achievement. This step allowed the researcher to identify the extent to which students demonstrated creativity within the structure of the learning model. Finally, the achievement of students' creative thinking skills was analyzed across all syntaxes of the C-R-E-A-T-E model, enabling the researcher to interpret patterns, highlight strengths, and identify stages where creative engagement appeared most prominent.

3. Results and Discussion

The study involved 20 eleventh grade science students from a senior high school who had not yet learned the lesson of natural acid base indicators. The research was conducted during the even semester, at a time when the class was still highly accustomed to conventional, teacher centered instructional practices. Their learning routine mainly consisted of listening to lectures, taking notes, and completing predetermined exercises, which provided very little space for students to question, explore, or experiment with the learning material. Because the activities were largely procedural and directed by the teacher, students rarely had opportunities to express their own ideas, make connections beyond the textbook, or propose alternative explanations. The classroom environment also offered limited stimuli for creative engagement, since most tasks focused on obtaining correct answers

rather than encouraging divergent thinking or idea generation. As a result, the learning atmosphere became passive, and students seldom practiced flexible thinking, originality, or elaboration of ideas, which are essential components of creativity that were not sufficiently supported in their usual classroom setting.

Student participation in discussions was also low, as many students lacked confidence in expressing their ideas or trying new approaches to problem-solving. Collaborative learning and tasks that encouraged idea elaboration were rarely implemented, which meant that students' creative potential was not optimally supported. Under these classroom conditions, the implementation of the C-R-E-A-T-E learning model became highly relevant, as the model provides opportunities for observation, exploration, analysis, and idea development in a more open and student-centered way. Through its structured stages, the C-R-E-A-T-E model encourages students to think creatively, generate their own ideas, and take a more active role in the learning process. Thus, the use of this model was expected to enhance students' creative thinking skills and offer a more meaningful learning experience.

The C-R-E-A-T-E learning process was carried out with the support of structured task sheets that guided students through activities such as questioning and answering, reading and interpreting information, constructing arguments, participating in discussions, deciding on the product to be created, applying and using their knowledge, collaborating, and presenting their results. The data consisted of scores obtained from observation instruments used to assess the implementation of the C-R-E-A-T-E learning model. The analysis was conducted by converting the raw scores into percentages for each syntax of the learning model. The total scores were then calculated, and the achievement was compared with the maximum possible score for the measured skill. After that, the students' creative thinking skill achievement was analyzed for each syntax of the C-R-E-A-T-E model. Figure 1 shows the structured task sheet used as a learning medium during the implementation of the C-R-E-A-T-E model on the natural acid–base indicator lesson.

Bantu jawab pertanyaan-pertanyaanku yuli

1. Apa yang dapat kamu ambil dari cerita tersebut?

Jawaban Individu:

Jawaban Kelompok:

2. Apa saja beragam jenis bahan alami yang kamu ketahui atau yang ada di sekitarmu?

Jawaban Individu:

Jawaban Kelompok:

3. Apakah menurutmu semua bahan alami dapat dijadikan indikator asam-basa? Sebutkan apa saja bahan yang dapat dijadikan indikator asam-basa alami?

Jawaban Individu:

Jawaban Kelompok:

Figure 1. Structured Task Sheet for the C-R-E-A-T-E Model on the Preparation of Natural Acid–Base Indicators

Based on research and data processing, the results of the achievement of creativity skills through the application of the C-R-E-A-T-E learning model on natural acid-base indicator material are very good but fluctuating. Fluctuating is experiencing variations and is not stable. The following is the percentage of achievement of creativity skills towards each learning stage of the C-R-E-A-T-E model in the form of a bar chart on each syntax of the C-R-E-A-T-E learning model, namely: Connecting, Restructuring, Elaborating, Applying, Tasking, and Evaluating. Figure 2 shows the stages of the C-R-E-A-T-E learning model. Based on the picture above, the following is a description of each learning stage in this study.

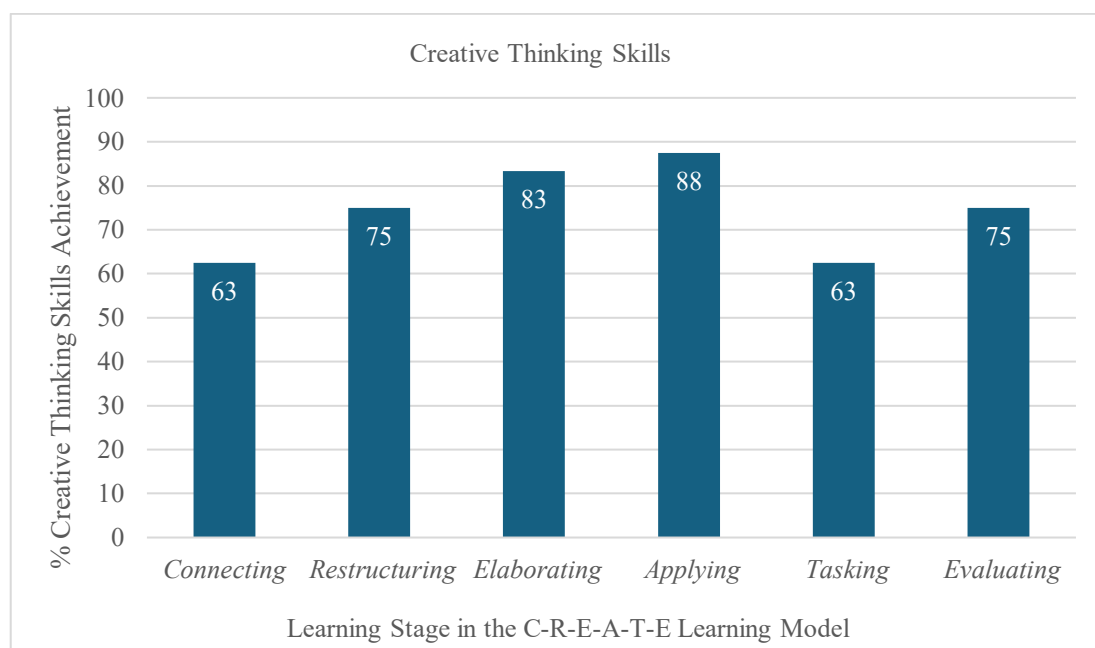


Figure 2. Achievement results of creative thinking skills

Connecting

At the Connecting stage, students conduct questions and answers and literacy. Students are expected to understand the discourse provided on the structured task sheet and be able to answer questions related to the discourse read both on the LTT and from the teacher. Students are required to have creativity skills in this learning stage. Based on the research data, the percentage of students' communication achievement at the Connecting stage is 63%. This means that the achievement of student communication is in the good category. This can be proven by the number of critical thinking indicators that are met and achieved at this stage of learning.

Restructuring

The Restructuring stage is a learning stage that directs students to reorganize their knowledge to avoid misconceptions. The rearrangement of knowledge is done by answering the questions contained in the LTT by discussing. The questions are designed to explore students' creativity. The questions are designed to encourage innovative and out-of-the-box thinking, stimulating students to develop new ideas

and possibilities. This stage aims to ensure all students have the same basic knowledge before moving on to the next learning (Wahyu, 2020). Based on the research data, the percentage of students' creativity achievement at the restructuring stage is 75%. This means that the achievement of student creativity is in the good category. This can be proven by the number of creativity indicators that are met and achieved at this stage of learning.

Elaborating

In the Elaborating stage, students elaborate on their knowledge to determine the creation of creative works. In this activity, students detail knowledge or ideas (Wahyu, 2020). In this learning, what is done is to determine the materials chosen to make natural acid-base indicators. Students are expected to write down what materials might be used as natural acid-base indicators based on availability, uniqueness, or other considerations by students in the group. Then students choose one of the many materials they think of along with the reasons. Students are expected to be able to elaborate on their respective knowledge to make group decisions related to the creative work made. In this study, each group was conditioned by the teacher to choose materials that were not common or had never been made as natural acid-base indicators so that students were required to have creativity skills. Based on the research data, the percentage of students' creativity achievement at the Elaborating stage is 83%. This means that the achievement of student creativity is in the very good category. This can be proven by the number of critical thinking indicators that are met and achieved at this stage of learning.

Applying

The Applying stage is a learning stage that directs students to apply or apply knowledge to create creative work procedures and optimize them so that optimal procedures are obtained (Wahyu, 2020). In this learning, students creatively arrange tools, materials, and procedures to make natural acid-base indicators from surrounding materials. However, due to time constraints, optimization is not carried out so that students immediately carry out the procedure at the next stage. Creativity skills are closely related to the Applying stage. This is because creativity facilitates the application of knowledge in innovative and effective ways, allowing individuals to utilize their knowledge in new and productive ways (Wahyu, 2018). Based on the research data, the percentage achievement of students' creativity skills at the applying stage is 88%. This means that the achievement of student communication is in the good category. Compared to other learning stages, this stage has the highest achievement. This can be proven by the number of critical thinking indicators that are met and achieved at this stage of learning.

Tasking

The The tasking stage was conducted outside of class time so that the activities were not observed by the observer thoroughly. This is because students are free to do this stage anywhere and anytime. At this stage students realize the design of making creative works that have been prepared in the previous stage (Wahyu, 2020). In this

study, what was done was the making of creative works of natural acid-base indicators. Based on the research data, the percentage of students' communication achievement at the restructuring stage is 63%. This means that the achievement of student communication is in the good category. This can be proven by the number of critical thinking indicators that are met and achieved at this stage of learning.

Evaluating

At the Evaluating stage, activities are carried out to evaluate the creative work made by students. The evaluation in question is carried out by presenting the results of creative work made by the group and then given responses by students from other groups and from the teacher. students are expected to present creative work made in the form of videos (Wahyu, 2020). In this study, the creative work displayed was a natural acid-base indicator and the color changes caused by the selected materials in an acidic and alkaline atmosphere. Afterward, students gave responses in the form of criticism or suggestions for the natural acid-base indicators displayed.

Creativity skills are closely related to the Evaluating stage. It aims to assess how this creativity is applied in the creative work of making natural acid-base indicators. An effective evaluation process helps identify strengths, weaknesses, and provides feedback that supports improvements for the next creative work (Wahyu, 2016). Based on the research data, the percentage of students' communication achievement at the evaluating stage is 75%. This means that the achievement of student creativity is in the good category. This can be proven by the number of critical thinking indicators that are met and achieved at this stage of learning.

4. Conclusion

Based on the results of research and discussion, it can be concluded that the achievement of 21st century skills through the application of C-R-E-A-T-E model learning on the lesson of natural acid-base indicators for grade XI high school students as a whole is categorized as very good but fluctuating. The achievement of creativity skills through the application of C-R-E-A-T-E model learning is categorized as very good at the Applying stage. At this stage, students creatively arranged the tools, materials, and procedures needed to produce natural acid-base indicators using ingredients available in their surroundings. This demonstrates that the Applying stage effectively supports students in transforming conceptual understanding into meaningful creative actions, allowing them to design, test, and refine their ideas in a practical context. In this stage, students' creative thinking achievement was very high because the activities required them to independently plan their work, make decisions about the design of their indicator, and adapt their procedures based on observations and experiment outcomes.

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