

## THE EFFECT OF PROJECT-BASED LEARNING THROUGH ARTIFICIAL INTELLIGENCE (AI) IN INCREASING STUDENTS' CREATIVITY AND LEARNING ACHIEVEMENT

Anita Debora Simangunsong<sup>1</sup>, Hamela Sari Sitompul<sup>2</sup>, Eva Pratiwi Pane<sup>3</sup>, Golda Novatrasio Sauduran<sup>4</sup>

Email: [anitadebora491@gmail.com](mailto:anitadebora491@gmail.com), [hamelasari@gmail.com](mailto:hamelasari@gmail.com), [evapратиwi2607@gmail.com](mailto:evapратиwi2607@gmail.com), [golda.sauduran@uhn.ac.id](mailto:golda.sauduran@uhn.ac.id)

<sup>1,3</sup>Universitas HKBP Nommensen Pematangsiantar, Indonesia

<sup>4</sup>Universitas HKBP Nommensen, Indonesia

<sup>2</sup>Universitas Deli Sumatera, Indonesia

### Abstract

This research aims to increase student creativity and learning achievement by implementing a project-based learning model through Artificial Intelligence (AI). This research is Classroom Action Research which was carried out in two cycles. Each cycle has four stages: planning, implementation, observation, and reflection. The research subjects were 22 first semester students of FKIP, HKBP Nommensen Pematang Siantar University. Data collection techniques through observation, interviews, document studies, questionnaires and tests. The analysis technique used in this research is descriptive qualitative. In Cycle I, the percentage of student creativity reached 45.45% and increased to 86.26% in Cycle II. The percentage of completion of the student knowledge learning aspect in Cycle I was 59.09% and increased to 90.90% in Cycle II. Based on the research results, it can be concluded that the application of a project-based learning model through Artificial Intelligence (AI) can increase student creativity and learning achievement in the Basic Chemistry course for FKIP students at HKBP Nommensen University.

**Keywords:** creativity and learning achievement, Artificial Intelligence, project based learning model

### Abstrak

Penelitian ini bertujuan untuk meningkatkan kreativitas dan prestasi belajar mahasiswa dengan menerapkan model pembelajaran berbasis proyek melalui Artificial Intelligence (AI). Penelitian ini adalah Penelitian Tindakan Kelas yang dilakukan dalam dua siklus. Setiap siklus memiliki empat tahap: perencanaan, pelaksanaan, observasi, dan refleksi. Subjek penelitiannya adalah mahasiswa semester I FKIP Universitas HKBP Nommensen Pematang Siantar yang berjumlah 22 orang. Teknik pengumpulan data melalui pengamatan, wawancara, studi dokumen, kuesioner, dan tes. Teknik analisis yang digunakan dalam penelitian ini adalah deskriptif kualitatif. Pada Siklus I, persentase kreativitas mahasiswa mencapai 45,45% dan meningkat menjadi 86,26% pada Siklus II. Persentase penyelesaian aspek pembelajaran pengetahuan mahasiswa dalam Siklus I adalah 59,09% dan meningkat menjadi 90,90% pada Siklus II. Berdasarkan hasil penelitian, dapat disimpulkan bahwa penerapan model pembelajaran berbasis proyek melalui Artificial Intelligence (AI) dapat meningkatkan kreativitas dan prestasi pembelajaran mahasiswa pada mata kuliah Kimia Dasar pada mahasiswa FKIP Universitas HKBP Nommensen.

**Kata Kunci:** kreativitas dan prestasi belajar, Artificial Intelligence, model pembelajaran project based learning

### Introduction

Along with the development of Information Technology, learning with ICT or e-learning supports the transformation of learning from conventional (traditional) education to distance education (distance e-learning) (Alshubiri et al., 2019). E-learning provides various web-based platforms or in the

form of social media where users can search for web-based platforms or in the form of social media where users can search for information (Jašková, 2014; Setiawan & Luthfiyani, 2023). Communicate and build friendships between users and the accounts they have. E-learning is a new approach that developed from the technological era, which has provided an alternative approach in the field of education (Valverde-Berrocso M, 2020). Before the COVID-19 pandemic, learning was carried out face-to-face. E-learning is only used to support learning, especially for students and teachers who cannot be physically present. However, e-learning is currently not only used as a support but as the main means so that the delivery of material to students can be achieved optimally (Alghamdi, 2020).

Information Technology which is increasingly developing has become one of the necessities needed in all sectors and aspects of life, including business, economics and education (Budiman, 2017). This happens because adjustments to people's needs for seeking information can be helped by the existence of Information Technology. Educational institutions, especially universities, are a place where a teaching and learning process takes place (Purwakarta Digital Network, 2022).

The existence of AI has had a significant impact on the world of education. With its ability to analyze and process data, AI has provided innovative solutions and enabled a more personalized and adaptive learning approach. Students are no longer just stuck with conventional learning methods, but they can access educational resources tailored to their individual needs (Muarif et al., 2019).

A teaching-learning process takes place. One very important part of educational development is learning planning. Learning planning is the act of formulating learning objectives including approaches, models, strategies, methods and techniques that will be used in learning (Fachri, 2020). Learning planning also includes consideration of material, how to deliver it, as well as preparing the tools and media used. All of this is chosen in planning with the hope that learning will achieve predetermined goals (Mekwong & Chamrat, 2021; Saputra & Serdianus, 2023). Learning planning is a very important thing to implement in the learning process. This is related to the understanding of learning itself as an action in which students and educators interact, so that two-way communication occurs (Ibrahim, 2014).

Considering that learning is an interaction between educators and students, careful planning is very necessary, namely by implementing a learning model. The project-based learning model is process-centered, relatively time-based learning, problem-focused, meaningful learning units that combine concepts from a number of components, be it knowledge, scientific disciplines or fields. In project-based learning, learning activities take place collaboratively in heterogeneous groups (Kristanti et al., 2017).

The project-based learning model helps students learn: (1) solid and meaningful-use knowledge and skills built through authentic assignments and work; (2) expanding knowledge through the authenticity of curricular activities that are contained in the learning process of planning (designing) or open-ended investigations, with results or answers that are not previously determined by a particular perspective; And; (3) building knowledge through real-world experiences and interpersonal cognitive negotiations that take place in a collaborative work atmosphere (Santi, 2011).

This research was conducted to determine the effect of project-based learning through artificial intelligence (AI) on the understanding of HKBP Nommensen University students. This influence includes several aspects, namely aspects of knowledge, critical thinking skills, collaboration, creativity, communication and technology. Not only that, this research can identify the application of character education and the Internet of Things to learning at HKBP Nommensen University. With this research, it is intended to obtain more specific information regarding the effectiveness of learning systems that collaborate with technology.

## Method

This research is Classroom Action Research which was carried out in two cycles. Each cycle has four stages, namely planning, implementation, observation and reflection (Arikunto, 2012). The research subjects were first semester FKIP students at HKBP Nommensen Pematang Siantar University. The selection of subjects in this research was based on the results of observations made during the pre-cycle, where the subjects selected were identified as having problems in learning, namely creativity and low learning achievement.

The data collected includes data about students' conditions in the form of qualitative and quantitative data. Qualitative data was obtained from observations, questionnaires and interviews. Quantitative data was obtained from the results of assessing student learning achievement in the Basic Chemistry course which includes aspects of student knowledge and creativity.

The data analysis technique in this research uses qualitative descriptive analysis. The qualitative analysis technique used refers to the Miles & Huberman (1995) analysis model which is carried out in three components, namely data reduction, data presentation, and drawing conclusions. In this study, triangulation techniques were used to check the validity of the data in the research. Triangulation is a technique for checking the validity of data that uses something other than the data for checking purposes or as a comparison of the data (Afrizal, 2016).

## Results and Discussion

### Results

Based on the results of pre-action identification, it is suspected that there are problems in low creativity and student learning achievement. Therefore, improvements are needed by implementing a project-based learning model through artificial intelligence (AI).

Action planning includes preparing learning instruments and assessment instruments. Learning instruments include syllabus, RPS, and AI application concepts in making presentations. The assessment instrument includes assessing aspects of student knowledge, attitudes, skills and creativity.

#### 1. Cycle I

This research was conducted with lecturers starting lecture activities by providing apperception to students. Next, the lecturer directs students to sit in groups. Lecturers distribute project assignments to all students.

Then convey the concepts related to the lecture material. The next stage the lecturer provides several problems for students to solve in groups. Then students discuss in groups to solve the problems given. After students have finished discussing with their groups, the next step is to present the results of the discussion in front of the class. Presentations made by students must involve AI, so that students can involve technology in creating learning media. After the presentation stage is complete, the lecturer equalizes perceptions and provides reinforcement of the concepts that students have learned. This is done to make students understand more about the material they have studied.

At the end of the lecture, the lecturer guides students to conclude what they have learned. Next, the lecturer gives post test questions. At the last meeting, a final evaluation of cycle I was carried out consisting of a knowledge test, creativity test and attitude questionnaire.

In general, the implementation of the project-based learning model through artificial intelligence (AI) in cycle I has gone well. The interaction between students and students in groups and the interaction between students and lecturers looks quite good during the lecture process. From the first meeting to the fourth meeting, student activity in lectures was also good. The data obtained in this research includes student learning achievement data on aspects of student knowledge, attitudes, skills and creativity.

Based on the results of creativity tests carried out by students, the results obtained can be seen in Table 1.

Table 1. Results of Cycle I Creativity Test	
Criteria	Achievement
High Creativity Medium	45,459%
Creativity	31,81%
Low Creativity	22,72%

Based on Table 1, student creativity is quite good. The percentage of completion has reached the predetermined target, namely 65.76% of the total number of students who have high creativity. In the knowledge aspect, 13 students (59.09%) have achieved completion, while 9 students (40.90%) have not yet completed it.

Based on the results of the assessment of creativity and learning achievement in the knowledge aspect, it can be seen that there are aspects that have not reached the specified target, namely the assessment of learning achievement in the knowledge aspect. Therefore, it is necessary to carry out

follow-up actions in cycle II so that the percentage of achievement of all indicators can reach the specified targets.

## 2. Cycle II

Based on the results of the reflection from cycle I, the researcher together with the basic chemistry course lecturer jointly carried out action planning in cycle II. Cycle II is more focused on improving the obstacles that occurred in cycle I. The lecture material provided is also focused on competency indicators that have not reached completeness in cycle I. The actions taken in cycle II are as follows, the first is changing student study groups based on results of the first cycle knowledge aspect test. This is intended so that students who have completed and mastered the material better can help their group friends if they encounter difficulties.

Second, lecturers identify learning difficulties experienced by students by approaching students. Third, lecturers monitor student discussion activities more during the lecture process. The lecturer walks around during the discussion process and the lecturer asks each group about the difficulties they are facing, and finally the lecturer instructs the students to work on the discussion questions individually. This is intended so that all students have answers to the problems given by the lecturer, so it is hoped that this will make it easier for students to learn. In this way, it is hoped that the results will be better and can achieve the target.

Cycle II was carried out in 2 meetings. The first meeting is for the delivery of material and the second meeting is for the final evaluation of cycle II. Based on the results of creativity tests carried out by students, in cycle II, it can be seen in table 2.

Table 2. Results of Cycle I Creativity Test

Criteria	Achievement
High Creativity Medium Creativity	86,26 %
Low Creativity	13,63 %
	0 %

The results obtained were that 19 students (86.26%) had high creativity, 3 students (13.63%) had moderate creativity. In the knowledge aspect, all competency indicators measured have reached the predetermined targets.

From the analysis of learning achievement in the knowledge aspect, it is stated that the number of students who have completed it is 20 students or 90.90%, while the number of students who have not completed it is 2 students or 9.09%.

Based on the results of the assessment of creativity and learning achievement, the knowledge aspect experienced an increase in achievement and had exceeded the target so that the research ended in cycle II.

## 3. Comparison of Cycle I and Cycle II

One of the learning achievements that determines the success of learning is the learning achievement in the knowledge aspect. In this research, the assessment of learning achievement in the knowledge aspect was carried out through tests carried out at the end of each cycle. The results of the second cycle knowledge aspect test stated that the number of students who had completed it was 20 students or 90.90%, while the number of students who had not completed it was 2 students or 9.09%. From these data it can be seen that there has been an increase in the percentage of completion from cycle I to cycle II. The increase in test results for the knowledge aspects of cycle I and cycle II can be seen in Figure 1.

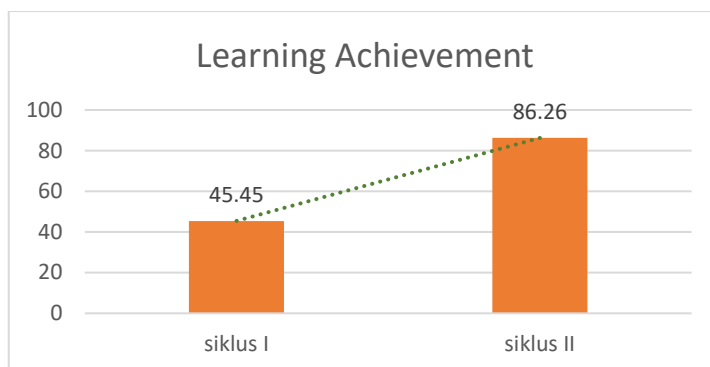


Figure 1. Diagram of Completeness of Learning Achievement in the Knowledge Aspects of Cycle I and Cycle II

The increase in learning achievement in the knowledge aspect in cycle II was due to the fact that in cycle II learning was focused on providing material for indicators that had not been completed. Apart from that, the study groups in cycle II were also changed based on the results of the knowledge aspect test at the end of cycle I. This was intended so that students who had completed and understood the material could help their group friends who did not understand the material.

Student creativity tests are carried out at the end of each cycle. Based on the results of the creativity test analysis, students are classified into 3 categories, namely students who have high creativity, students who have moderate creativity, and students who have low creativity. Students are said to be complete in the creativity aspect if the student falls into the high creativity category.

Based on the results of the creativity test in cycle I, there were 10 students who had moderate and high creativity (45.45%), and 5 students who had low creativity (22.72%). Meanwhile, based on the results of the creativity test in cycle II, there were 19 students who had high and moderate creativity (86.26%), and 0 students who had low creativity (0%). The increase in students' creative learning completeness in cycle I and cycle II can be seen in Figure 2.

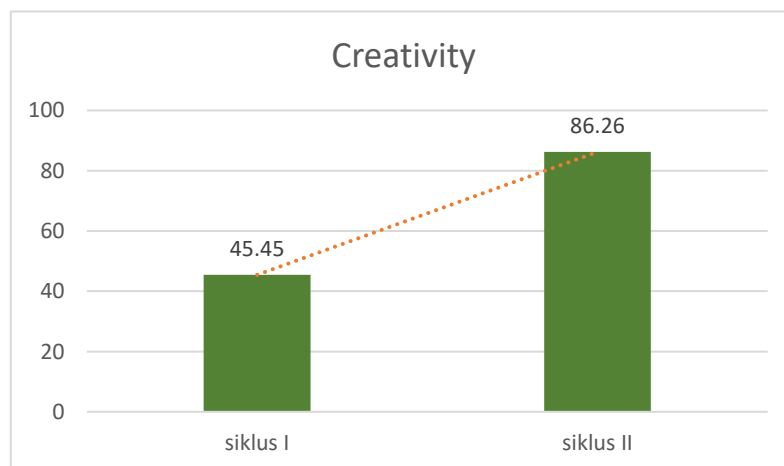


Figure 2. Diagram of Completeness of Student Creativity Cycle I and Cycle II

## Discussion

One of the factors that causes increased student creativity is the learning model used in the learning process. The application of a project-based learning model through artificial intelligence (AI) makes students participate actively in analyzing problems and exploring information in learning materials. when discussing with group members because students are required to find their own concepts (Sidik et al., 2016). The project-based learning model means students design a problem and find their own solution. The project-based learning model has the advantage of its characteristics, namely helping students design a process to determine an outcome, training students to be responsible in managing information carried out on a project and finally students producing a real product resulting from the students themselves. which is then presented in class (Amirudin & dkk, 2015; Jašková, 2014).

In applying artificial intelligence (AI), students are faced with a variety of technological information to design and present discussion results. Students are required to create ideas quickly related to solving existing problems. According to (Dakhi, 2022), that through this project, students together with their group friends will look for various alternative solutions to problems. Students will relate one formula to another formula. After finding the relationship between one formula and another, students can use it to solve problems. Through the problem solving process, students can develop their creativity (Amril & Thahar, 2022; Anggraini & Wulandari, 2021).

The use of AI can improve conceptual understanding, problem-solving abilities, and overall academic results. Apart from that, the use of AI also has a positive relationship with student involvement in the learning process. Students tend to be more active, involved, and participate in learning that involves AI technology. Additionally, the use of AI also contributes to learning satisfaction, with students reporting higher levels of satisfaction with learning that uses AI (Muarif et al., 2019). In the context of higher education, AI can help create more personalized, adaptive and interactive learning experiences (Korinek & Stiglitz, 2021). AI can identify students' learning needs and preferences, provide timely feedback, and provide customized learning materials. This can increase learning effectiveness, optimize student engagement, and increase learning satisfaction. This research can be concluded as successful because each indicator of the learning process and achievement includes student creativity and learning achievement from the knowledge aspect is measured as having reached the target and experienced an increase (Saputra & Serdianus, 2023).

## Conclusion

Based on the results of research that has been carried out, it can be concluded that the application of a project-based learning model through artificial intelligence (AI) can increase student creativity and learning achievement in Basic Chemistry courses.

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