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Chat Gpt : Improving Biology Learning Outcomes Problem-Based Learning Assisted Artificial Intelligence

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ABSTRACT

Learning outcomes are an assessment of success in education, where success is achieved when learning objectives are met. To measure this achievement, learning outcome tests are used by providing numerical assessments. This research study aims to identify the improvement of students' cognitive learning outcomes through the implementation of the Problem-Based Learning (PBL) model assisted by Artificial Intelligence (AI): ChatGpt. Cognitive learning outcomes hold significant value as they are used as indicators to evaluate the achievement of learning objectives and provide benefits for students in developing their thinking abilities to tackle various problems. The research adopts a quantitative descriptive approach, with the research subjects being students of X - 5 class at SMAN X Purwosari. The Classroom Action Research (CAR) was conducted during the period of March to May 2023, consisting of two cycles. The CAR stages include planning, implementation, observation, and reflection. The research results demonstrate a significant improvement in students' cognitive learning outcomes, with an increase of 25% in cycle 1 and 77% in cycle 2.

Chat GPT: Meningkatkan Hasil Pembelajaran Biologi dengan Pendekatan Pembelajaran Berbasis Masalah Berbantuan Kecerdasan Buatan

ABSTRAK: Hasil pembelajaran adalah penilaian keberhasilan dalam pendidikan, di mana keberhasilan dicapai ketika tujuan pembelajaran terpenuhi. Untuk mengukur pencapaian ini, ujian hasil pembelajaran digunakan dengan memberikan penilaian numerik. Penelitian ini bertujuan untuk mengidentifikasi peningkatan hasil belajar kognitif siswa melalui implementasi model Pembelajaran Berbasis Masalah (PBM) yang dibantu oleh Kecerdasan Buatan (AI): ChatGpt. Hasil belajar kognitif memiliki nilai yang signifikan karena digunakan sebagai indikator untuk mengevaluasi pencapaian tujuan pembelajaran dan memberikan manfaat bagi siswa dalam mengembangkan kemampuan berpikir mereka untuk mengatasi berbagai masalah. Penelitian ini mengadopsi pendekatan deskriptif kuantitatif, dengan subjek penelitian adalah siswa kelas X - 5 di SMAN X Purwosari. Penelitian Tindakan Kelas (PTK) dilakukan selama periode Maret hingga Mei 2023, yang terdiri dari dua siklus. Tahapan PTK meliputi perencanaan, implementasi, observasi, dan refleksi. Hasil penelitian menunjukkan peningkatan signifikan dalam hasil belajar kognitif siswa, dengan peningkatan sebesar 25% pada siklus 1 dan 77% pada siklus 2.

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INTRODUCTION

Learning outcomes are an assessment of success in education, where success is achieved when learning objectives are met (Baber, 2020);(Harris & Clayton, 2019). Crompton et al. (2020) said to measure this achievement, learning outcome tests are used by providing numerical assessments. The numbers obtained from the tests serve as indicators of learning success (Supena et al., 2021). However, it is important to remember that learning outcomes cannot be achieved without going through the learning process. The learning process plays a role in shaping students' ability to receive instruction (Ardiana & Ananda, 2022). This ability will encourage students to actively participate. With an effective learning process, students can actively engage throughout the knowledge transfer process (Uci & Junaidi, 2022). Through an effective learning process, students can utilize their knowledge optimally to achieve ideal learning outcomes (Jdaitawi, 2019).

When students achieve successful levels of cognitive learning in school, it can reflect the quality of education within the institution, indicating that the learning process is running smoothly (Dwijayani, 2019). Evaluation of cognitive learning outcomes can be done through the use of knowledge tests, such as exams or assessments conducted at the end of the learning process (Post et al., 2019). Assessment plays a crucial role in the learning process, as the grades obtained from the learning process serve as a tool to measure individual students' learning outcomes in relation to the teachings provided by the teacher (Damopoli et al., 2019);(Hartikainen et al., 2019).

Based on the observations conducted through a question and answer interview on March 3, 2023, with the students of SMAN X Purwosari, it is evident that a majority of the students do not understand the content taught, and the learning process is not tailored to the individual characteristics of the students. As a teacher, it is crucial to pay attention to the unique characteristics of each individual. The issue observed in class X-5 is the low cognitive learning outcomes in the previous semester, where overall, the students scored below the school's set indicator of learning goal achievement (IKTP), which is 75. Another issue is the underutilization of technology as a learning medium, especially the use of Artificial Intelligence (AI) chatbots. This is in line with the research that has been carried out by Siregar et al. (2019) and Hidayat & Subekti (2022), that the problem of student learning outcomes must be improved in the learning process , one of which is by choosing learning media that has a good impact on students.

Artificial Intelligence (AI) as part of technological advancements, has facilitated the field of education and learning (Zhai et al., 2021). Many AI-based systems are commonly used in education, such as virtual mentors, voice assistants, innovative content, smart classrooms, automated assessment, and personalized learning (Dlamini et al., 2020). The majority of users of these systems in the Industry 4.0 era are Generation Y, Z, and Alpha (Siddiq, 2023). These generations are known as digital natives who have a better understanding of computers and the internet compared to previous generations (Pillai & Sivathanu, 2020).

There are tasks and challenges that require solutions in the educational environment, especially for teachers. According to Hilir (2021), around 54 percent of the digital generation in Indonesia are internet users. Considering this data, the tendency of students being familiar with the internet makes the role of teachers in the current generation challenging. Therefore, it is expected that teachers possess skills in artificial intelligence systems. (Lund & Wang, 2023). Furthermore, AI-based education platforms that are integrated with real teachers can have a positive impact on education and learning. The role of teachers in this context may be conflicting rather than collaborating with machines that have the ability to communicate online in responding

to students' questions. One type of AI-based machine is Chat-GPT. (Hidayanti & Azmiyanti, 2023) argue Chat-GPT capabilities are able to provide lessons of many things, either simple or complex, that produce relevant answers. Di et al., (2023) also argues that Chat-GPT opens up new opportunitiesin education to improve interaction, providing feedback quickly. Chat-GPT is able to personalize learning according to individual needs (Ramadhan et al., 2023).

Based on initial observations of the learning process, during the lessons, the teacher consistently employs a monotonous lecturing style, resulting in students' lack of active engagement. This is evident when the teacher is conducting the lesson, as students appear unfocused, engaging in conversations with peers, and frequently involved in activities unrelated to the lesson, such as using their phones, entering and exiting the classroom, as well as doodling on desks and books (Gordon, 2020);(Pawlak et al., 2022). The knowledge transfer process is predominantly centered around the teacher and rarely utilizes instructional media and technology (Haka et al., 2021). The lack of variation in the learning process creates a dull learning atmosphere (Syara et al., 2020). Students feel bored and unmotivated as their activities mostly involve passive listening and note-taking (Sari et al., 2021). When the teacher prompts students to ask questions about the material, they remain silent, leading the teacher to assume that the students have understood the content. The students' unresponsiveness affects the learning situation and renders the process passive (Al Fatihah et al., 2022). According to Andini & Saifuddin (2023), The learning process and situation tend to be inactive, making it challenging to develop students' skills in constructive thinking to build ideas and concepts, ultimately resulting in a lack of student engagement. The teacher is also aware that the knowledge transfer during the teaching and learning process is not engaging, preventing students from developing critical thinking skills to better understand the material. The impact of this passive learning process affects students' grades in biology (Siau & Wang, 2020).

After examining the challenges faced in practice, it is important for teachers to make improvements to enhance the quality of cognitive learning outcomes. One way to improve students' cognitive outcomes is by implementing the PAIKEM (Active, Innovative, Effective, and Fun) learning approach. One solution to apply the PAIKEM approach and enhance students' cognitive outcomes is by using the Problem-Based Learning (PBL) model (Verawati et al., 2022). This approach aligns with the views expressed by Irwandani et al., (2019) that PBL is an innovative learning model that encourages students to actively engage in the teaching and learning process by presenting problems that need to be solved using higher-order thinking skills. PBL also involves students in independent problem-solving, which can train critical, active, and creative thinking skills in developing cognitive abilities. This view is in line with the opinion of (Nurkhin et al., 2020) that PBL can enhance students' knowledge and motivation, which in turn improves the learning process and students' skills in retaining and applying knowledge more effectively.

The PBL model of instruction has a focus on the learners. This approach applies constructivist principles to encourage collaboration and active student participation in the learning process (Seibert, 2021). This model can train individuals to analyze, identify, and find solutions to the problems they encounter (Suryawati et al., 2020);(Susanto et al., 2022). According to Angelica & Novitasari (2020) it includes: 1) problem orientation; 2) organizing for learning; 3) guiding inquiry; 4) developing and presenting outcomes; 5) analyzing and evaluating problem solving.

Based on the existing context, the researcher chose to use the PBL model with the assistance of AI, specifically Chat-GPT, as

an effort to enhance the learning outcomes of Biology for the 10th grade students in class X-5 at SMAN X Purwosari.

METHOD

The research conducted by the researcher is a type of Classroom Action Research (CAR), using a descriptive quantitative approach with the aim of visualizing the research problem and the impact of the actions taken. This research was conducted at SMAN A Purwosari from March to May 2023. The research subjects consisted of 36 students from class X5 of SMAN A Purwosari in the academic year 2022/2023. The research consists of two cycles, with a target of achieving a classical improvement of 70%. The research design is adapted from the model Kemmis & Mc. Taggart (2010), which consists of four steps: 1) planning, 2) action, 3) observation, and 4) reflection. Here is an overview of the steps in Classroom Action Research, as shown in Figure 1.
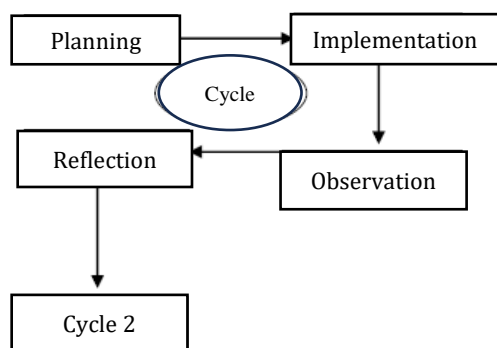

Figure.1 Step CAR

The data from the research above was analyzed quantitatively to estimate the percentage based on the results of the final learning examination in class X-5 at SMAN X Purwosari. The success indicator of the PTK implementation is if the students' proficiency reaches the learning achievement target of 75%.

RESULT AND DISCUSSION

There was an improvement in cognitive learning outcomes after implementing the AI-assisted PBL model:

ChatGpt. The average results in the first cycle were 57%, while in the second cycle, it reached 76%. The frequency distribution of grades in the post-test of the first and second cycles can be seen in the following table1.

Table. 1. Frequency distribution of posttest cycle 1 and 2

Value Intervals	Frequency	
	Postttest cycle 1	*Postest cycle2*
<50	13	3
51-60	7	3
61-70	7	2
71-80	6	19
81-90	3	6
91-100	0	3

Based on the implemented CAR, it can be concluded that there has been a significant improvement in overall cognitive learning outcomes of the students. The comparison of success rates in achieving the level of mastery of cognitive learning outcomes can be found in the following table 2.

Table 2. Comparison of the percentage of students who fulfill IKTP from cycle 1 to 2

Cycle	The Percentage of CognitiveLearning Outcomes of Students who Meet the IKTP
Cycle 1	25%
Cycle 2	77%

Based on the research results presented in Table 2, it can be observed that in cycle 1, the minimum criteria for the classical percentage were not met, as only 25% of the students achieved scores above the threshold of the Learning Achievement Success Indicator of 75. The research was continued in cycle 2 to achieve the desired success. In cycle 2, the classical mastery percentage of the students showed a significant improvement, reaching 77%. This increase has met the minimum requirements set by the school, which is 70%. As a result, the research was discontinued after cycle 2.

The improved learning outcomes are undoubtedly influenced by the problem-based learning process aided by AI: ChatGpt. This learning process follows the steps of problem-based learning. During the learning

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process, students actively ask questions, express their opinions, and respond to the given materials. Dwivedi et al., (2021) argue the orientation phase of students towards the problem is crucial as it can generate students' interest in the topic, thus allowing the subsequent stages to proceed smoothly. Next, students are grouped to engage in discussions with their peers. Hassani et al., (2020) argue these discussion activities enable students to freely explore and exchange ideas based on their individual experiences and knowledge. Through exchanging ideas with their peers, students can broaden their perspectives to solve the problem. The initiative shown by students in discovering and seeking solutions to the problem will develop their critical thinking skills and active involvement in problem-solving (Vaishya et al., 2020).

The involvement of students in gathering information and finding answers also affects the effectiveness of the learning process during the stage of guiding individual or group investigations (Ozkan & Umdu, 2021). The information gathering process is reinforced with the help of AI: Chat-GPT as an analytical tool, which also enhances the knowledge transfer process. Through crossword puzzles, students strive to find answers and develop their critical thinking skills, leading to more active participation from initially reluctant students. The teacher also plays a crucial role in guiding individual or group investigations by providing instructions and guidance to students who encounter difficulties in operating AI: Chat-GPT. Siddiq (2023) said the teacher's role as a facilitator is vital in guiding students. Next, in the stage of developing and presenting the results of their work, this activity helps the teacher assess students' understanding of the subject matter and the extent to which students have built their knowledge. Students actively contribute their opinions, ask questions, and collectively formulate the results of their discussions. After the presentation is complete, the teacher conducts evaluation and reflection on the

teaching and learning process during the stage of analyzing and evaluating problem-solving (Dwivedi et al., 2021). This stage serves as the final step in the PBL model and serves to consolidate information after going through all the stages. The teacher and students together analyze the information obtained from the investigation and the processes undertaken to solve the problem.

In the context of Vygotsky's constructivism theory, this study demonstrates relevant results. This theory posits that learning is not merely memorization but a process of constructing knowledge based on experience (Kamaliyah et al., 2022). In this regard, students are engaged in inquiry, discovery, and problem-solving, enabling them to construct a deeper understanding. Thus, learning is not limited to passive reception of information through rote memorization alone (Marlin et al., 2023). Students are able to solve problems based on their existing knowledge or experiences. Through these experiences, students can construct their own knowledge to solve problems, thereby strengthening their memory and enhancing their understanding of the subject matter (Aisyah et al., 2019).

In this study, the construction of knowledge is facilitated by teacher guidance and collaboration with peers. Teachers facilitate the learning process by providing students with the freedom to explore, discuss, interact, and share thoughts with their peers. One of the tools that students can use to construct knowledge and enhance their performance in acquiring information is an AI chatbot system like Chat-GPT. AI-based guidance programs can improve students' performance and motivation in the learning environment. (Srinivasa et al., 2022). By offering customized and interactive assistance to students, AI technology such as chatbots can enhance the learning experience and increase student participation in the learning process. Previous research by Lund & Wang (2023) has revealed that Chat-GPT has tremendous power to advance academics in new ways.

However, it is important to consider how to use this technology responsibly and ethically as a professional to enhance our work rather than misuse it.

CONCLUSIONS AND SUGGESTIONS

The learning outcomes of students in class X5 of SMA Negeri A Purwosari have shown a significant improvement through the implementation of Problem-Based Learning (PBL) aided by AI: ChatGpt. The improved learning outcomes are undoubtedly influenced by the problem-based learning process aided by AI: ChatGpt. This learning process follows the steps of problem-based learning , it can be observed that in cycle 1, the minimum criteria for the classical percentage were not met, as only 25% of the students achieved scores above the threshold of the Learning Achievement Success Indicator of 75. The research was continued in cycle 2 to achieve the desired success. In cycle 2, the classical mastery percentage of the students showed a significant improvement, reaching 77%. This increase has met the minimum requirements set by the school, which is 70%. As a result, the research was discontinued after cycle 2. For researchers or teachers who want to apply ChatGpt and the PBL model, ensure that students use ChatGpt as a tool, not as the sole source of information.

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