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Implementation of Project Based Learning Based on Artificial Intelligence Platform to Increase Student Learning Motivation in Mathematics Learning at SMAN 1 Ngunut

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Abstrak

Dalam proses pembelajaran, peran model pembelajaran sangat penting karena keberhasilan kegiatan pembelajaran sangat bergantung pada model yang digunakan dan seberapa efektif model tersebut bekerja selama proses pembelajaran. Pembelajaran Berbasis Proyek (PjBL) adalah salah satu pendekatan pedagogi yang paling inovatif. Dalam dunia pendidikan, fokus utamanya adalah siswa, atau "berpusat pada siswa". Guru membantu dan mendorong siswa untuk belajar secara mandiri. Penelitian ini menggunakan pendekatan kualitatif dengan paradigma interpretatif atau post-positivistik. Data diperoleh secara alamiah dan bersifat alamiah. Peneliti tidak menetapkan lokasi penelitian sesuai dengan keinginan peneliti. Penggalian data menggunakan teknik wawancara mendalam, kemudian observasi partisipatif dan kelengkapannya menggunakan dokumentasi. Informan yang menjadi sasaran peneliti meliputi kepala sekolah dan guru-guru yang terkait dengan pembelajaran matematika. Hasil yang bisa dikemukakan adalah Kurikulum Mandiri memungkinkan penggunaan berbagai model pembelajaran, tetapi diharapkan pendekatan yang lebih berpusat pada siswa akan digunakan. Model pembelajaran berbasis proyek adalah salah satu contoh pendekatan yang berpusat pada siswa. Dengan menerapkannya, siswa mungkin lebih mahir dalam perkalian dan pecahan. Model pembelajaran berbasis proyek dilaksanakan dengan mengarahkan siswa untuk mengkonstruksi sendiri pengetahuan dan pemahamannya dalam memahami materi matematika. Kemampuan siswa dalam memahami materi matematika dapat ditingkatkan karena siswa mengimplementasikannya secara langsung dalam sebuah proyek. Sehingga pada akhirnya model pembelajaran berbasis proyek dapat digunakan untuk meningkatkan kemampuan siswa dalam memahami materi matematika, terbukti dengan semakin meningkatnya pemahaman siswa terhadap beberapa ayat yang diajarkan dalam mata pelajaran matematika pada kurikulum merdeka. Kemampuan siswa dan motivasi belajar dalam memahami materi matematika meningkat seiring dengan pengimplementasian model berbasis proyek, namun tetap dalam pengawasan dan pengarahan fasilitator.

Kata Kunci: *Kecerdasan Buatan, Motivasi Belajar, Pembelajaran Berbasis Proyek*

Abstract

In the learning process, the role of learning models is crucial because the success of learning activities depends heavily on the model used and how effectively it works during the learning process. Project-Based Learning (PjBL) is one of the most innovative pedagogical approaches. In education, the primary focus is on students, or "student-centered." Teachers assist and encourage students to learn independently. This study uses a qualitative approach with an interpretive or post-positivistic paradigm. Data were obtained naturally and in a natural manner. The researcher did not determine the research location according to the researcher's wishes. Data collection used in-depth interviews, followed by participatory observation and documentation. The informants targeted by the researcher included school principals and teachers involved in mathematics learning. The results can be stated that the Independent Curriculum allows the use of various learning models, but it is hoped

that a more student-centered approach will be used. The project-based learning model is one example of a student-centered approach. By implementing it, students may be more proficient in multiplication and fractions. The project-based learning model is implemented by directing students to construct their own knowledge and understanding in understanding mathematics material. Students' ability to understand mathematics material can be improved because they directly implement it in a project. Ultimately, the project-based learning model can be used to improve students' ability to understand mathematics material, as evidenced by the increasing understanding of several verses taught in mathematics subjects in the independent curriculum. Students' abilities and motivation to understand mathematics material increase along with the implementation of the project-based model, but remain under the supervision and direction of the facilitator.

Keywords*: Artificial Intelligence, Learning Motivation, Project Based Learning*

Introduction

Learning is a change in behavior that occurs in a person and is the result of practice that is carried out directly and repeatedly.[1] This is also related to learning in the world of education, where in learning students are taught directly about the material through practice, not just in theory.[2] In this learning process, students are required to make active efforts to search for, find, analyze, formulate, solve a problem related to the subject matter and draw a conclusion from the problem. Students are expected to be motivated and happy when carrying out learning activities, because directed learning can make students understand the material being studied, especially in the aspect of understanding mathematic matter.

The Merdeka Belajar Curriculum provides freedom to students in learning, which encourages students to be active and participate. This curriculum is responsive to

[1] Zainal Abidin et al., "Implementation of Islamic Religious Education Learning and Character in the New Normal Era," *Al-Hayat: Journal of Islamic Education; Vol 6 No 1 (2022): Al-Hayat: Journal of Islamic EducationDO - 10.35723/Ajie.V6i1.239*, June 21, 2022, https://alhayat.or.id/index.php/alhayat/article/view/239; Adi Warma, Wangiman, and Neneng Wahyuni, "Improving Learning Outcomes Of Islamic Religious Education In Civil Decisions Material Implementing Prophets And Apostles Through Cooperative Learning Types Of Investigation Groups For Class V Students UPTD Negara 06 Koto Primary School, Guguak District," *IJGIE (International Journal of Graduate of Islamic Education)* 4, no. 2 (October 31, 2023): 314–24, https://doi.org/10.37567/ijgie.v4i2.2334.

[2] Ifa Lidia Wati and Rihab Wit Daryono, "The Effectiveness of the Quantum and Discovery Learning Models on Learning Achievement of Islamic Education in Junior High Schools," *IJORER : International Journal of Recent Educational Research* 5, no. 4 (July 30, 2024): 808–21, https://doi.org/10.46245/ijorer.v5i4.605.

educational needs that emerged during the recovery period after the implementation of the emergency curriculum during the COVID-19 pandemic.[3] The 2013 curriculum was used until 2022 when the Ministry of Education and Culture replaced it with the Independent Curriculum, now there are still several institutions that are adapting. Flexibility is one of the main principles of the Merdeka Curriculum.[4] Schools can choose teaching materials, learning methods, and evaluations according to their wishes so that they best suit students' needs. This concept provides greater opportunities for teachers to be creative and innovative in delivering learning so that an interesting and effective learning environment is created. This flexibility also helps to change according to different local conditions and cultures in various places. The independent curriculum places learning in the context of students' needs and situations, where they can begin to appreciate the relevance of what they are learning to their daily lives. This is important to increase student motivation and engagement in the learning process.[5] It is hoped that through this process, students will gain not only knowledge but also skills that are relevant and can be used in their lives. The goal of the independent curriculum is to improve the quality of education in Indonesia and equip students to face future challenges by developing character, skills and knowledge holistically. Independent learning emphasizes freedom and creativity of thought.

The role of learning models is very important in the teaching process because the success or failure of a learning activity depends greatly on the model used and its effectiveness during teaching. One of the innovative pedagogical approaches is Project Based Learning (PjBL).[6] In education, the main focus is clearly on students, so it is called student-centered, with teachers considered as motivators and facilitators, where

[3] Meria Ultra Gusteti and Neviyarni Neviyarni, "Pembelajaran Berdiferensiasi Pada Pembelajaran Matematika Di Kurikulum Merdeka," *Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika* 3, no. 3 (December 31, 2022): 636–46, https://doi.org/10.46306/lb.v3i3.180.

[4] Intan Jamilah, Rahayu Condro Murti, and Irul Khotijah, "Analysis of Teacher Readiness in Welcoming the 'Merdeka Belajar' Policy," *AL-ISHLAH: Jurnal Pendidikan* 15, no. 1 (February 3, 2023): 769–76, https://doi.org/10.35445/alishlah.v15i1.3085.

[5] Mikail Ibrahim et al., "Antecedents Of Intrinsic Motivation, Metacognition And Their Effects On Students' Academic Performance In Fundamental Knowledge For Matriculation Courses," *Malaysian Journal of Learning and Instruction* 14, no. 2 (December 2018): 211–46, https://doi.org/10.32890/mjli2017.14.2.8.

[6] Budi Tri Cahyono et al., "Development of Authentic Assessment with Project Based Learning Approach in Primary School Students," *QALAMUNA: Jurnal Pendidikan, Sosial, Dan Agama* 15, no. 1 (June 29, 2023): 539–48, https://doi.org/10.37680/qalamuna.v15i1.3987.

students are given the opportunity to work autonomously to build their own learning. This innovative instructional strategy called Project Based Learning, also known as PjBL, integrates projects into the instructional process. Teachers play the role of facilitators in Project Based Learning by assigning students to explore, assess, and interpret to create learning outcomes. Students are allowed to study independently for a certain period, which is called independent study.[7] A problem becomes the starting point that requires students to obtain information or data.

Through the explanation above, we can conclude that project based learning is a learning model that focuses on the activities of students to implement the concepts and principles they have learned, by conducting an in-depth analysis of an issue and finding solutions that are relevant to the issue. And students learn independently, and the results achieved from this learning are products. Therefore, this Project Based Learning model is planned to be integrated in the use of instructors to deal with complex problems.[8] So, in the implementation of this model, students must be observed and explored in depth and in innovative and more active learning conceptual inquiry through complex activities.

Therefore, this project-based learning model is very suitable to be applied to improve the ability to understand mathematics matter in SMAN 1 Ngunut's students. SMAN 1 Ngunut is a fairly well-known senior high school and has a good image in the perspective of the wider community. This is proven by the many people who choose SMAN 1 Ngunut as a place of Education for their children. The PjBL model is applied in SMAN 1 Ngunut to improve students' learning motivation. This is because the PjBL model is able to attract students' interest in learning mathematics and make mathematics learning easy to understand and can be applied in everyday life.

[7] Salman Alfarisi, Hani Yulindrasari, and Nandang Budiman, "The Creativity of Teachers in Implementing Learning Activities at Pesantren- Based Junior High School," in *Proceedings of the 1St International Conference on Toward Kalimantan as the New Capital of the Republic of Indonesia June* (Hotel Pantura Sambas, 2023).

[8] Safaruddin Safaruddin et al., "The Effect of Project-Based Learning Assisted by Electronic Media on Learning Motivation and Science Process Skills," *Journal of Innovation in Educational and Cultural Research* 1, no. 1 (June 27, 2020): 22–29, https://doi.org/10.46843/jiecr.v1i1.5.

Research Method

The approach used in this study is a qualitative approach, with a post-positivistic or interpretive paradigm. Data are obtained naturally and are natural. Researchers do not set the research location according to the researcher's wishes.[9] Data are excavated using in-depth interview techniques, then participatory observation and its completeness using documentation.[10] The informants that researchers target include school principals and teachers related to mathematics learning.

Data analysis is carried out using the Milles Huberman and Saldana model, which includes data condensation, data collection, drawing conclusions and verifying the results of the conclusions.[11] The data obtained is checked for validity with credibility using data source triangulation and method triangulation. The data obtained is also abstracted so that it can be applied in other places that have similarities or are almost the same, which is called transferability. Researchers also hold discussions with colleagues and research reviewers where this is called dependability.[12] Researchers verify the results of the abstraction and conclusions drawn by conducting confirmability.

Result and Discussion

In the implementation of the project-based learning (PjBL) model, there are several structured steps that guide the learning process, particularly in the context of mathematics learning supported by artificial intelligence (AI). These steps begin with determining the learning objectives, which ensures that both the project activities and the integration of AI align with the intended mathematical competencies. Next, educators proceed with designing the project plan, where the scope, expected outcomes,

[9] Rahfit Syahputra and Fini Fajri Mulyani, "Qualitative Approach Dominates Character Education Research in History Education Journals in Indonesia," *Journal of Innovation in Educational and Cultural Research* 6, no. 1 (January 15, 2025): 104–15, https://doi.org/10.46843/jiecr.v6i1.2020.

[10] D.M. Mertens, *Research and Evaluation in Education and Psychology_ Integrating Diversity With Quantitative, Qualitative, and Mixed Methods* (California: Sage Publications, 2009).

[11] Luthfiyah Muh Fitrah, *Metodologi Penelitian (Penelitian Kualitatif, Tindakan Kelas Dan Studi Kasus)* (Bandung: CV Jejak, 2017).

[12] Muftahatus Sa'adah, Gismina Tri Rahmayati, and Yoga Catur Prasetiyo, "Strategi Dalam Menjaga Keabsahan Data Pada Penelitian Kualitatif," *Jurnal Al 'Adad: Jurnal Tadris Matematika* 1, no. 2 (2022).

and the role of AI tools are clearly defined. Following the planning phase, teachers prepare a project schedule that outlines timelines, milestones, and deadlines to help students manage their time effectively. During the project implementation, teachers take an active role in monitoring and evaluating students' progress, offering guidance, feedback, and support as needed. This is followed by the development and refinement of student projects, where learners apply mathematical concepts with the aid of AI tools to create innovative solutions or products. Finally, the process concludes with a reflection and evaluation phase, where students analyze their learning experiences and outcomes. This step helps reinforce their understanding of the mathematics material, fosters metacognitive skills, and encourages them to connect theory with practical application. By integrating AI into PjBL, the learning becomes more interactive, personalized, and aligned with 21st-century skills, ultimately enhancing students' comprehension and engagement with mathematical concepts.[13] Based on the results of research conducted by researchers from 6 steps that encourage students' creative thinking skills, namely project testing. Project testing in its implementation is focused on students, students are asked to create projects and present the results of the projects that have been made. This has indirectly improved students' ability to understand mathematics material in learning. In understanding mathematics material, students do not only read the improved abilities, but rather focus on the ability to understand fractions, sin, cos, tan. The ability to understand fraction material is not only limited to the technical aspects of addition, subtraction, but also includes understanding fraction algorithms, and is influenced by internal and external factors. In the aspect of project testing, students must understand it themselves with the help of the internet and artificial intelligence, then in understanding the fraction algorithm, students must find answers to the questions given via gpt or elicit chat and be able to present them in front of friends and teachers.

One of the models applied is project based learning. The reason for applying this model is to see how much the students' creative thinking skills have increased. The

[13] Munirah Munirah et al., "Penerapan Model Berbasis Proyek Dalam Meningkatkan Keterampilan Menulis Teks Prosedur Siswa Kelas VII H SMPN 21 Kota Makassar," *Fon: Jurnal Pendidikan Bahasa Dan Sastra Indonesia* 17, no. 2 (October 29, 2021): 272–80, https://doi.org/10.25134/fon.v17i2.4744.

increase in question is from the students' thinking skills before the project based learning model is applied and after using this model. The application of project based learning usually and on average includes a cycle of activities from observation, data collection, creation of works, exhibitions, and evaluation. Meanwhile, a large project should begin with long-term planning, and be accompanied by scheduling for various activities.

From the series of activities in the project based learning above, here students are expected to combine all ideas from groups formed in the class into one agreement, from this agreement a central premise will be formed. Through this, they are also expected to be able to define the contents of the group statement through small discussions, with their group mates, in order to obtain a method or process to jointly maintain what is proposed in the central statement. The most important thing is the integration of the desires and ideas of students from each class.

This opinion is in line with the mathematic learning process at SMAN 1 Ngunut, where project based learning has been applied. At this stage, it is specifically for teachers to carry out initial planning activities in the project based learning methodology related to the introductory discussion scheme which is a question that triggers a problem, or the teacher can invite students to discuss first. At this stage, the teacher divides students into several groups and provides an explanation of how to create a project.[14] At this stage, students complete the project by accompanying friends in the group. At this step, the teacher monitors how active students are in completing the project and in this section, the teacher's job is to provide guidance if there are obstacles. At this step, students are asked to show others the results of the project they have completed, and the teacher provides an assessment. At this stage, the teacher provides an evaluation or useful suggestions as a follow-up to the student's project.[15] The focus of learning lies on the core principles and concepts of the discipline, involving students in

[14] Nurul Ostiqomah, Agnes Sudjanuawarini, and Vivi Rulviana, "Implementasi Pembelajaran Berbasis Proyek Untuk Meningkatkan Hasil Belajar IPA Dengan Bantuan Alat Peraga Pada Siswa Kelas V SDN 03 Klegen Kota Madiun Tahun Pelajaran 2023-2024," *Pendas: Jurnal Ilmiah Pendidikan Dasar* 09, no. 2 (2024).

[15] Heri Ginanjar et al., "Keberhasilan Implementasi Pembelajaran Berbasis Proyek: Faktor- faktor Kunci dalam Proses Pembelajaran," *Jurnal Pendidikan Tambusai* 5, no. 1 (2021).

problem-solving investigations and other meaningful tasks, giving students the opportunity to work autonomously in constructing their own knowledge, and culminating in producing real products.

Project-based learning (PjBL) is an instructional model that integrates projects as a central element in the learning process. These projects, which can be carried out individually or in groups, are conducted over a defined period and are designed to encourage collaboration among students. The primary goal is to produce a tangible product or outcome that is later showcased or presented. The implementation of projects in this model is characterized by collaborative, innovative, and creative approaches that focus on solving real-life problems relevant to students' experiences. As a learner-centered approach, project-based learning shifts the focus from the teacher to the student. It encourages students to take an active role in constructing knowledge, exploring ideas, and applying skills in meaningful ways. This model stands in contrast to traditional teacher-centered instruction, which often positions students as passive recipients of information. In PjBL, students are empowered to engage deeply with content, think critically, and collaborate effectively—making learning more dynamic, contextual, and impactful.

.[16] This results in low student learning motivation so that their scientific performance decreases.

Project-based learning is a learning model that uses problems as the first step in integrating new knowledge based on real experiences.[17] Project-based learning is carried out systematically, involving students in learning attitudes, knowledge and skills through investigations in product design. Project-based learning is an innovative learning model, which emphasizes contextual learning through complex activities.[18]

[16] Septi Anggraini, "Learning Concepts Learning Approach Models in Improving Students' Understanding of Mathematical Concepts," *EDUCTUM: Journal Research* 2, no. 5 (September 30, 2023): 1–4, https://doi.org/10.56495/ejr.v2i5.416.

[17] Mariyam Shareefa et al., "Teachers' Perceptions on Differentiated Instruction: Do Experience, Qualification and Challenges Matter?," *International Journal of Learning, Teaching and Educational Research* 18, no. 8 (September 15, 2019): 214–26, https://doi.org/10.26803/ijlter.18.8.13.

[18] Bruce Joyce, Marsha Weil, and Emily Calhoun, *Models of Teaching* (San Fransisco: Mc Graw Hill Inc, 2005).

Project-based learning lets students think carefully and use their creativity by coming up with ideas to make real things like products or services. In this kind of learning, students work on projects that teachers give them, and they take an active role in solving the problems. They handle their learning by doing real tasks that lead to real results. This makes the learning process meaningful and helpful in the end. [19] Project-based learning (PjBL) offers a learning environment that reduces competition in the classroom by encouraging students to work collaboratively rather than individually. This model fosters cooperation and teamwork while also allowing students to take ownership of their learning. Through PjBL, students engage in constructing knowledge and developing new skills, which are then applied to create meaningful, real-world products.

According to Bie, as cited in Safaruddin et al., project-based learning is a model that emphasizes conceptual understanding [20] and the integration of disciplinary principles. It supports instructional goals by guiding students through problem-solving activities and authentic tasks that encourage independent learning, balanced engagement, and the production of valuable and realistic outcomes.[21] The project-based learning model can foster a more orderly learning attitude in students and can make students more active and creative in learning. The project-based learning model also has great potential to create a more interesting and meaningful learning experience.[22] In addition, the project-based model also facilitates students to investigate, solve problems, be student-centered, and produce real products in the form of project results.

[19] Stefanus C Relmasira and Agustina Tyas Asri Hardini, "Meningkatkan Motivasi dan Hasil Belajar IPA dengan Menggunakan Model Pembelajaran Project Based Learning (PjBL)," *Journal of Education Action Research* 3, no. 3 (2019).

[20] Ahmad Mohammad Ahmad Aloqleh and Kamarul Shukri Mat Teh, "The Effectiveness of Metacognition on Academic Achievement among the Jordanian Universities Students," *International Journal of Academic Research in Business and Social Sciences* 9, no. 9 (September 21, 2019): Pages 460-478, https://doi.org/10.6007/IJARBSS/v9-i9/6315.

[21] Safaruddin et al., "The Effect of Project-Based Learning Assisted by Electronic Media on Learning Motivation and Science Process Skills."

[22] Hafizah Mohamad Hsbollah and Haslinda Hassan, "Creating Meaningful Learning Experiences With Active, Fun, And Technology Elements In The Problem-Based Learning Approach And Its Implications," *Malaysian Journal of Learning and Instruction* 19, no. 1 (2022), https://doi.org/10.32890/mjli2022.19.1.6.

In this context, the role of the teacher is crucial. Rather than serving as the sole source of knowledge, the teacher functions as a facilitator and guide who controls and monitors the learning process.[23] The teacher acts as a timekeeper, helps mediate conflicts among students, fosters cooperation, and enhances group dynamics.[24] Furthermore, the teacher observes group behavior, encourages student interaction, supports the expression of ideas, and motivates students to develop confidence in their abilities while recognizing and addressing their own limitations.[25] This supportive role is essential to ensure the success of the project-based learning approach and to maximize students' growth in both academic and social competencies.

The ability to understand mathematics matter that can be improved for students at the SMAN level is at all levels, only the capacity is still quite basic and has not entered an advanced level of understanding and in-depth and detailed analysis. This ability can be used by SMAN students to be able to pass the practical exam and the final exam class which is carried out in class X.

Conclusion

The Merdeka Curriculum gives teachers freedom in choosing how to teach, but it is expected that the teaching method used should focus on the student. One such method is project-based learning, which is a student-centered approach. Using project-based learning can help improve students' reading skills, especially in tajwid and reading fluency. In this model, students are guided to build their own knowledge and understanding of math topics. Their ability to understand math can improve because they apply what they learn directly in a project. As a result, project-based learning can

[23] Relmasira and Hardini, "Meningkatkan Motivasi dan Hasil Belajar IPA dengan Menggunakan Model Pembelajaran Project Based Learning (PjBL)"; John W. Thomas, *A Review of Research on Project-Based Learning* (San Rafael, CA: The Autodesk Foundation, 2000).

[24] Miftahul Putri Deya and Tressyalina, "Pengaruh Penggunaan Model Project Based Learning Berbantuan Lingkungan Terhadap Keterampilan Menulis Teks Puisi Siswa Kelas VIII SMP Negeri 1 Kerinci," *Educaniora: Journal of Education and Humanities* 1, no. 1 (March 1, 2023): 90–96, https://doi.org/10.59687/educaniora.v1i1.14.

[25] Johri Sabaryati et al., "Implementasi Pembelajaran Berbasis Proyek Terhadap Hasil Belajar Di Sekolah Menengah Dan Perguruan Tinggi: Meta Analisis," *ORBITA. Jurnal Hasil Kajian, Inovasi, dan Aplikasi Pendidikan Fisika* 8, no. 1 (2022); Fatma Sari, Zulfani Sesmiarni, and Susanda Febriani, "Implementasi Pembelajaran Berbasis Proyek Untuk Meningkatkan Mutu Pendidikan Di SMAN 5 Payakumbuh," *Al I'tibar: Jurnal Pendidikan Islam* 11, no. 3 (2024).

help students better understand math subjects, as shown by their improved grasp of various math-related verses in the merdeka curriculum. This method can also boost students' ability and motivation to learn math, but it is done with the help and guidance of the teacher.

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