

The Influence of Machine Learning on the Student Learning Psychology in Industry 5.0

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Abstract

This study aims to examine how the application of a machine learning-based learning system to students' learning psychology. This study focuses on improving the quality of learning that not only pays attention to cognitive aspects, but also to students' emotional aspects that often affect their academic achievement. This study uses a qualitative approach with a descriptive research type to explore students' experiences in using a machine learning-based system in the learning process. Data collection techniques are carried out through interviews, observations, and documentation, with data analysis using the Miles and Huberman model. The results of the study indicate that the application of this system is effective in reducing academic anxiety (Academic Anxiety Reduction), increasing students' self-confidence through positive reinforcement (Increased self-confidence through positive reinforcement), and developing students' emotional resilience (Positive Resilience to Emotional Learning). The contribution of this study is to provide new insights into the role of technology, especially machine learning, in supporting the development of students' emotional intelligence which can ultimately improve their academic well-being.

Keywords: Machine Learning, Learning Psychology, Academic Anxiety Reduction, Self-Confidence, Positive Reinforcement

Article History:

Received: January 2024; Revised: March 2024; Accepted: June 2024

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DOI: <https://doi.org/10.61987/edsojou.v1i2.635>

How to Cite:

Mutmainnah, I., Shodiq, J., & Faizah, N. (2024). The Influence of Machine Learning on the Student Learning Psychology in Industry 5.0. *Education and Sociedad Journal*, 1(2), 83-93.

INTRODUCTION

Industry 5.0 is the latest phase in the evolution of the Industrial Revolution, which focuses on integrating humans and machines into the work environment (Raja Santhi & Muthuswamy, 2023; Taj & Zaman, 2022). Unlike Industry 4.0, which emphasizes automation and connectivity through the Internet of Things (IoT) and artificial intelligence (AI), Industry 5.0 emphasizes closer collaboration between humans and technology to increase social value and sustainability (Kasinathan et al., 2022; Mourtzis et al., 2022). Within this framework, Machine Learning (ML) plays a crucial role in supporting the personalization and adaptation of systems that can predict individual needs, including in the context of learning (Gligorea et al., 2023; Jafari & Yazdi, 2024; Song et al., 2024). The impact of ML developments in Industry 5.0 extends to various sectors, including education, where adaptive and data-driven learning will become increasingly relevant (Demartini et al., 2024; Saharani & Diana, 2024). Machine Learning enables education systems to analyze students' behavior, progress, and learning styles in real time and provide more precise and personalized recommendations (Liu & Yu, 2023; Luan & Tsai, 2021; Munir et al., 2022). In the digital era, positive changes are taking place in how students interact with learning technology, driven by Machine

Learning's ability to provide a more personalized and adaptive learning experience.

This phenomenon includes changes in student motivation, engagement, and understanding influenced by applying advanced technology in education. With the help of ML algorithms, learning systems can detect students' learning patterns, including the difficulties they face, their learning style preferences, and their emotional tendencies while learning (J. Li & Xue, 2023; Lu et al., 2022; Maisuroh & Aisyah, 2024; Sanusi et al., 2023). This allows for more timely interventions, such as providing additional materials or rearranging learning methods, which can affect students' academic performance and psychological development (Kikalishvili, 2024; Yabanova & Demirkan, 2021; X. Zheng et al., 2023). In addition, using ML to analyze big data from students' interactions with learning materials also enriches the understanding of how psychological factors, such as test anxiety or self-confidence, affect their learning process.

Gligorea et al. (2023) stated that implementing ML algorithms in adaptive learning platforms can increase student motivation by providing more constructive and relevant feedback. ML can increase student engagement through content adjustments based on student learning behavior analysis (Fadli Hidayat et al., 2024; Khaira et al., 2023; Mijangos et al., 2023). Roos et al. (2021) revealed that ML helps in identifying test anxiety in students, thus allowing adjustments to materials to reduce stress. Students who use ML-based learning systems have a better understanding of the material because the adaptation made by the system is according to their learning pace (Albreiki et al., 2022). Hermiyati et al. (2024) stated that machine learning can increase student self-confidence by providing data-based recommendations about their strengths and weaknesses. Systems that rely on ML can improve student emotional management and reduce academic stress through timely interventions (Dasi et al., 2023; Surahman & Wang, 2022; J. Zheng et al., 2024). Machine learning can improve collaboration between students and teachers through platforms that support data-based interactions.

The research focuses on the technical aspects of implementing ML in the education system without exploring its impact on the psychology of student learning. In addition, most studies have not sufficiently explored the interaction between psychological factors and technology in the context of learning personalization and how these two elements influence each other. This study attempts to fill this gap by delving deeper into how Machine Learning can affect psychological aspects such as motivation, anxiety, and students' self-confidence. In addition, this study will introduce novelty by examining the role of collaboration between humans and machines in learning systems.

The main objective of this study is to understand the influence of Machine Learning on students' learning psychology in the context of Industry 5.0 progress in students at Al-Muntahy Islamic College. The study seeks to identify how machine learning algorithms can affect students' psychological factors, such as motivation, anxiety, and engagement in learning. Thus, this study can contribute new insights into how technology can be integrated more effectively into education to support students' psychological development and facilitate more efficient learning. This study also seeks to provide recommendations for the development of learning strategies that utilize the full potential of Machine Learning to improve the quality of education.

This study is important because it can contribute to education development in the Industry 5.0 era, emphasizing the integration between humans and machines. By exploring the influence of Machine Learning on students' learning psychology, this study not only provides a deeper understanding of the impact of technology on students' cognitive and emotional aspects but also introduces the potential for more personalized and practical learning. The main contribution of this study is developing a more holistic approach to understanding the interaction between student psychology and learning technology. In addition, this research is expected to provide a strong

foundation for developing data-based learning systems that can be adapted to individual student needs, thereby encouraging more optimal academic achievement.

RESEARCH METHOD

This study uses a qualitative approach with a descriptive research type (Mulisa, 2022). The qualitative approach was chosen because this study aims to understand the phenomena that occur among students of the Al-Muntahy Islamic College, especially related to the influence of the use of machine learning-based learning systems on academic anxiety, self-confidence, and emotional resilience. The subjects of this study were active students at the Al-Muntahy Islamic College who were involved in the use of machine learning-based learning systems. The selection of subjects was carried out using a purposive sampling technique, by selecting students who had used the system in their learning process.

Data collection techniques used in this study include interviews, observations, and documentation (Matos et al., 2023). Interviews were conducted with two lecturers and three students who had been involved in the use of machine learning-based learning systems. This interview aims to gain an in-depth view of their experiences in using the system, as well as its impact on their academic anxiety, self-confidence, and emotional resilience. Observations were conducted to monitor student interactions with the learning system and their behavior in the academic environment. Documentation was also used to collect information related to the material provided by the system and feedback received by students, which was then analyzed to see the extent of its influence on their emotional development.

Data analysis in this study uses the data analysis model according to Miles and Huberman, which consists of three main stages: data reduction, data presentation, and drawing conclusions (Leko et al., 2021). In the data reduction stage, researchers identify relevant information from interviews, observations, and documentation to focus on findings related to academic anxiety, self-confidence, and emotional resilience. The selected data is then presented in a clear and structured narrative to facilitate understanding. Finally, conclusions are drawn by examining the patterns that emerge from the analyzed data, which are then used to provide a comprehensive picture of the effect of using a machine learning-based system on students' emotional aspects.

FINDINGS AND DISCUSSION

Academic Anxiety Reduction

Academic anxiety in the Al-Muntahy Islamic Religious College, which often arises before exams or when assignments pile up, has become a common problem among students. Researchers seek to explore the application of machine learning-based learning systems to detect signs of academic anxiety in real-time. The findings of the study show that by using machine learning technology that is integrated with student learning behavior patterns, appropriate interventions can be given to alleviate these anxieties. The system is not only able to identify anxiety symptoms, but also provides solutions in the form of lighter learning materials and positive feedback that can reduce student stress.

Most students experience academic anxiety, especially when facing exams or assignment deadlines. From the observation of their behavior, a consistent pattern was found, namely decreased focus on learning and increased emotional tension before the exam. Machine learning-based learning systems successfully detect these changes and provide lighter material and positive feedback designed to relieve stress. To further clarify the research findings, the following Figure 1 can be used as a basis to understand the overview of the research findings on the process of identifying student anxiety.

Machine learning-based learning systems can detect signs of academic anxiety in students through real-time analysis of learning behavior. With algorithms that are able to identify changes in learning patterns, the system can provide interventions in the form of lighter material or provide positive feedback to help students manage stress. This can reduce exam anxiety and increase students' confidence in the learning process.

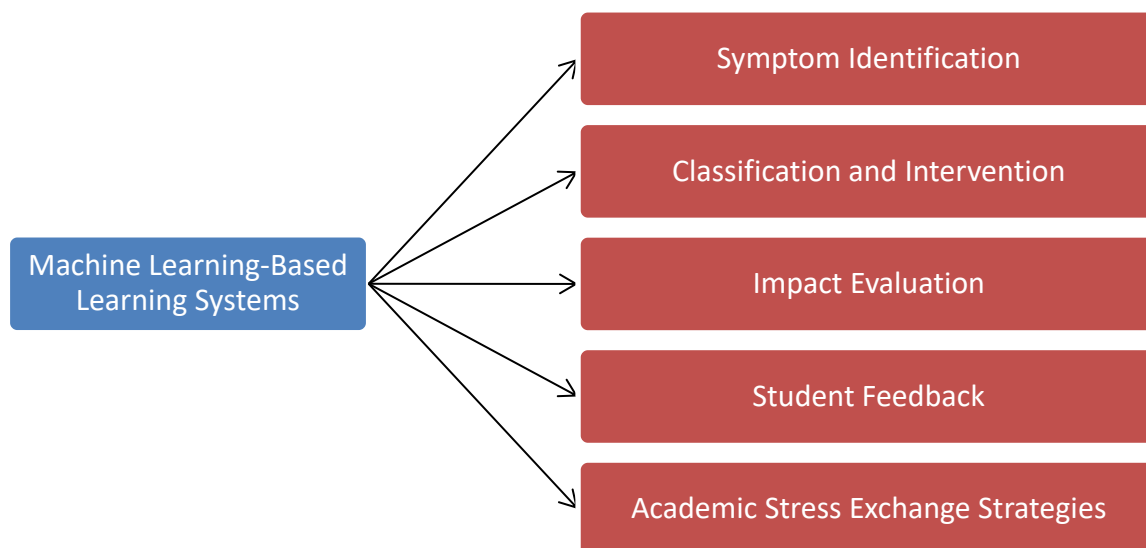


Figure 1. Machine Learning-Based Learning Systems

Figure 1 shows that machine learning-based learning systems have a positive impact on reducing academic anxiety among students. With early detection of signs of anxiety, the system can provide a more precise and quick response, both in the form of lighter material and positive feedback. This helps students to feel more controlled and confident in facing exams or big assignments. In addition, positive feedback from the system provides the mental boost needed to increase their motivation to learn. The data showed that after the implementation of this system, college students showed a significant decrease in anxiety levels and an increase in their self-confidence.

Increased self-confidence through positive reinforcement

Positive reinforcement in the context of increasing the sense of self-awareness in the students of the Al-Muntahy Islamic Religious College refers to the feedback provided by the machine learning-based learning system, which is personalized and data-based, to show the positive development of each student. The findings of this study show that students who use this system are more likely to have a higher sense of self-confidence, because they can see the progress they are making in learning, as well as understand more clearly their strengths and weaknesses. This system provides more constructive feedback, which allows students to feel more confident in their ability to face academic challenges, especially during demanding exams or assignments. With regular positive reinforcement, students become more motivated and believe that they can achieve better results.

Students of the Al-Muntahy Islamic Religious College who were involved in the use of machine learning-based systems showed significant changes in their attitudes and behaviors towards learning. This observation is carried out by monitoring students' interaction with the system, as well as recording their responses to the feedback given. Most college students report that they feel more valued and more confident after receiving more structured, achievement-based feedback. For example, college students who initially felt unsure of their abilities, after receiving

positive feedback about the progress they had made, showed a significant increase in their self-confidence. In fact, they are more proactive in facing assignments and exams, feeling more prepared to overcome the challenges that exist.

Table 1. Aspects of Confidence

Aspects Observed	Description
Receiving Feedback	Students show a more positive attitude towards the feedback received, feel valued and motivated.
Increased Motivation	After receiving positive feedback, students are more active and confident in following the material and assignments.
Changes in Self-Perception	Students feel more confident in their ability to overcome academic challenges after receiving constructive feedback.
Trust in the Learning Process	Students become more confident in their ability to learn effectively, with a clear understanding of their strengths and weaknesses.
Response to Assignments and Exams	Students showed improvement in doing assignments and exams with greater confidence.

Table 1 illustrates the results of observations on changes in students' behavior after they received positive data-based feedback from a machine learning-based learning system. In terms of receiving feedback, students generally show better acceptance, with many of them feeling valued and more motivated to study harder. The increase in their motivation is obvious, both in class participation and in the absorption of learning materials. Students' self-perception has also undergone significant changes, where they feel more confident in their academic abilities after receiving positive feedback on the progress they have made. Their confidence in the learning process increases, as they have a clearer understanding of their strengths and weaknesses in a particular field of study. Students' responses to assignments and exams have changed, with those who were previously anxious or hesitant becoming more confident and ready to face the exams.

Positive feedback, provided by machine learning-based systems, plays an important role in boosting student confidence. When students are given clear reinforcement regarding their achievements, they feel more valued and more confident that they are able to overcome the academic challenges that exist. Data-driven feedback also provides clearer insights into their strengths in the learning process, so they can be more confident in facing exams or assignments. The data showed that students who received this feedback experienced an increase in their motivation and active participation, as well as feeling better mentally and emotionally prepared to face academic challenges. This positive reinforcement not only increases students' confidence but also encourages them to try harder and achieve better results.

Positive Resilience to Emotional Learning

Research on positive resilience to emotional learning among students at Al-Muntahy Islamic Religious College shows that the application of machine learning in education has great potential to support the development of students' emotional intelligence. Through a system that utilizes student behavior and interaction data, the management and improvement of emotional aspects such as empathy and self-control can be achieved more efficiently. Machine learning can be used to create a learning environment that supports students' emotional resilience in an academic context. Students at Al-Muntahy College have various social and cultural backgrounds that give their own color to their interactions with the academic environment. The results of this study show that with the right approach, such as the application of technology in emotional learning, students can face academic and social challenges better. This contributes to the formation of their character, which ultimately improves their ability to manage emotions and interact with others on campus.

The results of the interviews showed that both lecturers and students felt the importance of developing emotional intelligence in the teaching and learning process. Lecturers expressed that they often act as facilitators in helping students manage their emotions, both in dealing with academic stress and in social interactions. Meanwhile, students also acknowledged that understanding emotional intelligence, which includes empathy and self-control, is essential in supporting their learning process. The interview also illustrates how technology, especially machine learning, can be an effective tool for monitoring and directing students' emotional development.

Lecturer Ahmad said, "As an educator, I feel it is important to not only teach academic knowledge, but also guide students in managing their emotions. The use of technology in this case is very helpful, especially in understanding student behavior patterns that may not be directly visible in class." Lecturer Fatima, who is also involved in teaching at Al-Muntahy, added, "The application of machine learning in class allows us to monitor students' emotional development in real-time. This gives us the opportunity to provide more appropriate interventions that suit their needs." On the other hand, Student Aisyah shared, "I find it easier to manage my emotions after taking part in a learning program that includes elements of emotional intelligence. With the help of this technology, I can focus more on studying and interacting with my friends." Student Budi also gave a similar comment, "Sometimes I feel anxious about college assignments, but with a platform that teaches me how to manage my emotions, I feel calmer and can complete my assignments well." Lastly, Student Siti stated, "Machine learning gives me insight into how my emotions can affect my academic performance. By knowing this, I can be more careful in dealing with stressful situations."

The application of machine learning in emotional learning has had a positive impact on students at Al-Muntahy Islamic Religious College. Lecturers at this college are very supportive of the use of technology to help students manage their emotional intelligence, especially in dealing with academic stress and social pressure. This technology not only helps in terms of monitoring, but also provides recommendations that are tailored to the needs of each student. Students involved in the interviews felt that they were able to understand and manage their feelings more easily thanks to the use of a system that utilizes their behavioral and interaction data. Thus, they were able to create a balance between academic demands and their emotional well-being. Furthermore, these interviews showed that the emotional resilience built through this technology contributed to improving the quality of their social interactions, both with lecturers and fellow students.

Students at Al-Muntahy Islamic Religious College felt positive benefits from the application of machine learning in emotional learning. This technology not only facilitates the monitoring of students' emotional development but also provides them with tools to better manage their emotions. This has an impact on their ability to cope with academic stress, which in turn improves their academic performance. The lecturers involved in this study also acknowledged that this kind of technology gives them deeper insight into the emotional state of students, allowing them to provide more appropriate and personalized guidance. This interpretation of the data emphasizes the importance of integrating emotional aspects into education, which not only supports academic development, but also the psychological well-being of students. Thus, this study confirms that positive resilience in emotional learning can be achieved through the use of appropriate technology.

Discussion

The analysis of the findings of this study shows that machine learning technology can be a very effective tool in supporting students' mental well-being. A system capable of identifying academic anxiety in real-time allows for faster and more relevant interventions, which can prevent anxiety conditions from getting worse. The combination of technology and psychological approaches such as positive feedback and tailored materials has been shown to be effective in

reducing academic stress (Hehir et al., 2021; Ohadomere & Ogamba, 2021). This reflects the importance of developing an adaptive and responsive system to academic anxiety. The researchers also noted that although the system showed positive results, there were some challenges in terms of students' initial adaptation to the use of new technologies, as well as the need for further training for students to maximize the benefits of machine learning systems.

Agarwal and Sharma (2024) shows that the use of artificial intelligence-based applications in education can improve students' mental well-being. Technology-based interventions tailored to students' learning needs can significantly reduce their anxiety levels. Positive feedback given in the context of learning has a big impact in reducing academic stress (Ko et al., 2023; H. Li et al., 2023). Yang et al. (2024) showed that students who use machine learning-based technology in their learning tend to experience decreased anxiety and improved academic performance. The findings of this study support the existing literature on the great potential of technology in helping manage academic anxiety among college students.

The positive reinforcement provided through machine learning-based systems plays a big role in increasing student confidence. One of the important factors in this case is the nature of feedback that is constructive and data-driven. Student's structured, achievement-based feedback provides a clear picture of their progress, which in turn boosts their self-confidence. Luan and Tsai (2021) stated that constructive feedback can increase students' motivation and confidence in learning. Students who received positive reinforcement showed a significant improvement in their self-confidence, as well as in their academic performance.

The feedback system helps students to see that the progress they make is recognized and valued, which motivates them to continue learning and growing. However, there are several obstacles in the implementation of this technology, such as limited access to devices and the unpreparedness of some students to adapt to new technology. However, despite this, the positive impact of using this system on students' confidence is quite significant, and this study shows that the use of technology in education can provide very positive results if implemented correctly. The use of technology in learning has been proven to help students to be more confident because they can access faster and more personalized feedback (Kikalishvili, 2024; Munir et al., 2022; X. Zheng et al., 2023). Students who receive data-driven feedback tend to feel more empowered and confident in their abilities. Positive feedback plays an important role in building student confidence, especially in the context of technology-based learning. Positive reinforcement can increase student confidence, especially when delivered through advanced and data-based technology.

The application of technology, especially machine learning, in education can have a positive impact on students' emotional resilience. This is in line with the theory that technology can be an effective tool in supporting the development of emotional intelligence. Through a system that utilizes student behavior and interaction data, educators can more easily recognize and understand students' emotional conditions, and provide appropriate interventions (Ataman et al., 2024; J. Li & Xue, 2023; Yabanova & Demirkan, 2021). In addition, this finding also shows that students who receive good emotional learning tend to be better able to manage their emotions in stressful situations. This analysis suggests that technology can help create an academic environment that is more supportive of students' emotional well-being, which ultimately has a positive impact on their academic achievement.

The use of machine learning in education can improve students' ability to manage their emotions, especially when facing academic challenges (Agarwal & Sharma, 2024; Surahman & Wang, 2022). Technology that can monitor student behavior in real-time allows educators to provide more personalized guidance. Demartini et al. (2024) show that emotional intelligence can be learned and developed with the help of technology-based systems. The importance of

integrating emotional learning into education to create a better learning experience (Liu & Yu, 2023; Sanjani, 2024; Sanusi et al., 2023). Students who have good emotional intelligence are better able to deal with academic stress and improve their performance in school. These findings support the conclusion that technology can be a key factor in the development of students' emotional intelligence. The findings contain practical and theoretical contributions that convey that machine learning, which is the fruit of technological advances, can play an important role in students' psychological resilience.

CONCLUSION

The implementation of a machine learning-based learning system on students at the Al-Muntahy Islamic College can provide positive impacts including reducing academic anxiety, increasing self-confidence through positive reinforcement, and developing students' emotional resilience. The data-based system is able to detect academic anxiety in real-time and provide relevant interventions, increase students' self-confidence with constructive feedback, and help students manage and develop emotional skills such as empathy and self-control. However, this study has limitations, such as the limited sample used and the difficulty in students' adaptation to new technologies. Thus, recommendations for further research are to expand the sample to a more diverse sample, examine the effects of this system over a longer period of time, and explore ways to increase technology acceptance among students through more effective training and socialization.

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