Leveraging Artificial Intelligence to Combat Truancy and Enhance Classroom Engagement

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Abstract

Reforming truancy by addressing Students' global engagement is made possible by using Artificial Intelligence (AI) tools. AI technology facilitates real-time student monitoring, behavior and emotion analysis as well as designing custom learning experiences thus allowing educators to nurture evolving and encompassing classrooms. Using behavior analysis systems and individualized Instructional design tools of AI moderates better engagement and motivation thereby decreasing rates of truancy. Matched emotion recognition using deep learning models, passive biometric feedback interaction systems for engagement measurement and performance flakes are a few AI tools available today. Technologies such as these proactively allow classroom management to improve motivation rather than waiting for an issue to arise. Using interactive tutorials also helps students who find engaging with teachers hard through increasing talking and better content. Monitoring progress and providing feedback through AI also aids teachers in recognizing students who are unable to seek assistance on their own. AI in education as a whole faces a plethora of ethical problems such as data misuse, restrictive access or biased algorithms that AI has to incorporate to be successful. AI integration should be gradual as human intervention will become even more overshadowed by AI tools. AI applications in education can offer real-time assistance to students, help them to improve attendance and also create tailored, fun learning activities, which might help them in the longer term. This research also shows the great promise that AI holds in the field of education while stressing the need for a moral and prudent framework for its use.

Keywords: Truancy students; Absenteeism; AI and Classroom Management; Monitoring Student Progress; Effective Feedback for Student Motivation

Introduction

The incorporation of AI technology into the education sector has begun to yield solutions to handling truant students and improve engagement in the classroom. Teachers can observe and explain student behavior more easily with the help of these AI software solutions. Further analysis of the data provided by these tools assists educators in recognizing trends in student attendance and level of engagement. Consequently, this knowledge enables teachers to provide tailored learning opportunities to their students to ensure that no student feels neglected. Technology can help foster a sense of responsibility in them by encouraging the development of individualized learning strategies or educational plans so that students can be intrinsically motivated. Again, thanks to AI, lessons tend to become more fluid and flexible as the instructor can monitor students' comprehension of the material in real-time and make changes instantly. Such responsive action also acts as positive reinforcement to students. It motivates them to persist since they are aware of and comprehend the reasons behind their performance. Furthermore, AI can be a reliable source of solutions concerning student accountability. For instance, a student who has not logged into their class or whose attendance is suboptimal can trigger an alert to the teacher. Teachers can come in and assist the student in time, thanks to this abuse warning system in place that enables prompt action. This article identifies and articulates different ways AI technology can assist in engagement and attendance, making a case for the ability of AI to change the traditional modes of how education is delivered. With the help of areas like real-time behavior analysis, offering personalized learning, and effective feedback mechanisms we can have a glimpse of the potential the future holds. AI will make education, understanding, and learning more engaging to a wider audience of students.

Real-Time Behavior Analysis

In today's world, educational establishments must leverage real-time behavior analysis systems which employ artificial intelligence, embedded devices and image capture tools for monitoring student behavior alongside understanding their emotional status during classes. With this technology capabilities, it is easier for educators to understand how engaged the students are emotionally and tweak their teaching methods to improve the involvement of the students at the right moment. Recent developments made in ERAM models for emotion recognition have made it possible to target pupils who show indications of loss of attention or are not interested at times during class. This allows the teachers to practice self-regulation in how they conduct lessons, for instance — should the student's behavior indicate a loss of interest during the lesson, the instructor can be able to use different approaches to promote active participation (Dong, An & Liu, 2023). Imagine a system that picks signs of a student getting agitated and then gives out suggestions like stopping the class for a short break or turning into interactive activities for re-engaging the student. Lightweight models like the Person Interaction Detection Model (PIDM) when integrated into the embedded systems, provide opportunities for the recognition of emotions in a class setting in real-time. The use of such systems works best for instructors. These systems readily show the emotional state of students, which they depict during the class. Such systems have been found to improve instructor performance by closing the gap between teaching and information transfer by as much as around 10% (Li et al., 2023). Moreover, attributes basic training systems such as Convolutional Neural Networks (CNNs) and YOLOv5, to gauge attention levels of students regarding the lesson using facial expressions. The pupils are distinguished whether they are following attentively or not, based on whether they are engaged with the lesson, and these models show an average accuracy of around 76%. This technology assists educators to get a better view of their students'

requirements and modify their directions to enhance their achievements (Trabelsi et al., 2023; Alkabbany et al., 2023).

Behavioral and Emotional Engagement
- Biometric sensor networks and state-of-the-art computing devices are employed to monitor students' head orientation, eye attention and body language. It allows us to measure student engagement and emotional aspects during the lesson. It is versatile enough to be employed in different learning environments and thus is an asset for both the instructors and students (Khuntia & Kale, 2024).
- In the same vein, multimodal systems collect and process physical indicators of the engagement of students in the learning process. The indicators are facial gestures, blinking rates and head rotation. By analyzing such behaviors, the systems can estimate the engagement level of the students in real-time. Newer research shows these systems can achieve formidable predictive success rates of 92.58 % accuracy (Yin Albert et al., 2022). Such a level of accuracy can help greatly in gaining insights into students' interactions and their feelings within classroom settings.

Classroom Behavior Recognition
- Algorithms, such as 3D convolutional neural networks (3D-CNNs), and the enhanced single shot detection (SSD) models, serve a crucial function in recognizing classroom behaviors. Quite simply, these algorithms substantially improve the speed and accuracy of ascertaining student actions in real-time. This feature enables teachers to evaluate and analyze students in terms of their engagement and emotions during activities. Studies for example, Fernández Herrero et al. (2023) and Llurba et al. (2022), indicate that these technologies are efficient.
- These systems can show some particular actions in detail. They can, for instance, identify when a hand is raised to ask questions or when a student is busy with a mobile phone. Such knowledge is highly helpful to teachers. This knowledge enables teachers to alter how they deliver the concepts to their learners. The feedback supplied is quick and thus enables faculty and staff to design lessons and activities that are more learner-centered. A better understanding of student behavior makes it easier for teachers to build a learning environment that is conducive to both learning and the students' emotional health.

AI-based behavior analysis systems are on the rise in education systems across the globe. They could transform teacher-student interactions and the overall learning experience. Technological shortcomings, however, pose major challenges in the effective implementation of these tools. The inability to efficiently gauge emotional cues is the most notable challenge. This limits the scope of these tools to fully fit into the growing theories of emotional learning, like CVT (Control-value Theory of human emotions). The use of AI-based tools in classrooms raises a plethora of privacy concerns, in addition to struggles with accurately gauging emotions. There might be a necessity to collect and manage student data which, in turn, could shatter the present trust dynamics - students, parents, and schools. With a lack of stringent data protection policies, families would find themselves absent from adopting such technologies. Overdependence on these AI tools could result in a disconnect between teachers and students. Losing the invaluable teacher-student bond would be detrimental for an environment where personal connections matter the most. Teaching should be more than just analyzing data; it should revolve around understanding and empathizing with students. Teachers bring in abundant first-hand insights that cannot be supplemented. There

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are multiple exciting possibilities for real-time behavior management. AI will make it increasingly important to use this technology in classrooms in moderation along with deep, personal engagement with students. For example, if used blindly, the emergence of this technology might have negative effects on the quality of education. The implementation of these measures will solve the problems of ensuring that AI deployments improve the quality of education and learning, rather than hindering the processes. The use of these august technologies should be properly implemented considering ethical issues, as well excessive dependence on technology might take away the human factor of education (Gupta et al., 2023; Dukić & Sovic Krzic, 2022).

Personalized Learning and Engagement

AI can significantly enhance personalized learning and the specific areas of student engagement in the educational sphere. AI does this by taking learning experiences out of the ordinary and fitting them with the specific requirements of every student. AI takes into account different types of data such as the user's individual learning pattern, achievement levels and preferences. This enables AI to adapt the teaching materials and techniques to the individual requirements of each student. This strategy is crucial as it ensures students' willingness to participate actively in the learning process and enables them to have ownership of their learning.

Thus, such personalized learning pedagogy is likely to lower dropout rates and increase both student motivation and participation. If learners know that what they are learning is relevant to their interests and skills, they are more likely to become active learners. Also, AI Assistants contribute greatly in language learning. These engaging tools assist students in acquiring conversational skills through active and interactive tasks and exercises. Such an interactive learning atmosphere thus, not only keeps learners' attention but also extends and maintains their interest in the subject learnt. As a whole, every student benefits from AI since it makes education more efficient as well as more interesting.

- As noted in the article, AI technologies are gradually penetrating different fields, especially education. By analyzing huge amounts of data, these technologies can gather relevant information that grows tremendously the students' performance and deepens their interest in learning. The studies conducted by Dong et al. (2024), and Anand et al. (2023) demonstrate the measurable gains in academic performance, with the application of AI.

- More recently, AI and computer technologies have proved as game changers in education by providing unique and immersive tools for students, particularly in mathematics. In addition, they are extremely useful when it comes to enhancing the educational experience of learners and building their imagination. As stated by Ashwini et al. (2023), students are likely to be more interested in math concepts when they are provided with robotics and artificial intelligence since it promotes their active engagement.

- Another benefit of using AI education systems is the content and hints tailored individually to the students. Such systems are executed in a way to meet the diverse requirements of students therefore making sure that the needed assistance is provided in a way that suits the individual. The research of Anuyahong et al. (2023) shows that these platforms strengthen students' efficient learning strategies, therefore assisting them in enhancing their academic performance.

Language Learning and Conversational Skills

- The Internet of Things (IoT) and Generative AI united to profoundly change English language education by formulating more advanced oral skills evaluative methods. This integration of both IoT and Generative AI ensures that students' assessment is engaging and appeals to their specific needs. In today's scenario, educators can use different

technologies to customize the assessments, therefore making them more interesting for students. This paradigm shift in the use of technology in English language education has also led to the invention of novel and advanced methods for assessing students' focus (Sadykova, 2023).

- AI natural language processing (NLP) capabilities are also integral components of this educational approach. Such devices enable scholars to enhance their language proficiency via speech and writing analysis. Personalized information provided by AI gives learners recommendations on where they can improve. Students are motivated to practice more as this level of support provides opportunities for developing efficient communication skills. By applying these technologies, teachers and learners can enrich the teaching and learning processes, making them more interactive and effective for learning English and considering communication skills, along with the provision of necessary feedback and support (Charles, 2023)

Adaptive Learning and Assessment

- The growing relevance of AI-powered adaptive learning platforms is aimed at improving the learning experience of students. This also entails the amalgamation of various cognitive, behavioral and emotional aspects. Cognitive adaptation simply explains how students think or understand information as well as process it, whereas behavioral adaptation is concerned about what students do or answer in the course of learning. Affective adaptation is focused on emotions such as motivation muscle and anxiety. Through the synergy of these approaches, adaptive learning systems offer targeted exercises and materials that boost learners' effectiveness (Pendy, 2021). Such an approach has an impact on student satisfaction, as in this case, students can take more responsibility for their education.

- Within the sector of higher education, AI systems have had a favorable impact on student engagement and motivation. Students can relate better to the content and the work by the help of these systems that provide individualized learning experiences. Adaptive evaluations consider the student's past performance, which makes it possible to have a more precise measurement of his or her capabilities. This promotes students' motivation and engagement.

- However, the use of AI in education has its own set of obstacles. There are challenges such as concerns about the strength of bias in the algorithms and issues of ethically fragile data privacy. These challenges bring about the dire importance of the proper integration of the use of AI technologies in educational environments to protect the integrity and fairness of all students (Tiwari, 2023).

AI can enhance and constantly improve the effectiveness of learning by tailoring the experience to the requirements of the student. But, with such potential also come quite serious ethical and social issues. Privacy, where the personal data of students may be made available, is one of the such concerns. There is also the problem of discrimination, where the AI system might prefer certain groups of people while denying the opportunity to others.' These educational tools have potential only when available to everyone. Technology is not equally accessible, we know this. This means that the gap between those who benefit from AI and those who do not stand to widen. Hence it follows that knowing how the AI systems work is particularly important. All stakeholders, which means educators, parents, as well as policymakers and the like, must have a clear idea of the working of these systems. This leads to accountability, where those who are called upon to integrate AI into education must be held up to fairness standards. Before AI can be responsibly integrated into the education sector, there is ample research that needs to be conducted. Quite

importantly, this research must be comprehensive encompassing a variety of stakeholders. The advocacy of AI penetration and implementation should be equally balanced with the regulation of potential risks that come alongside it. A proper understanding is pivotal in the development of norms that govern how these environments should operate so that ethical considerations are not violated. Educators have the potential to utilize AI to a greater extent but this utilitarian approach must be suppressed with boundaries of transparency, accountability, and fairness all being upheld to maximize the advantages and minimize risk to the education industry (Harry, 2023; Anand et al., 2023).

Monitoring and Feedback Systems
AI monitoring systems aid by providing analysis of student involvement and focus. This feature allows teachers to gain insight as to whether or not a student is struggling or in need of any attention, solving issues before they get any worse. These systems use computer vision, machine learning and other technologies to track a student's behavior and analyze their emotional status. This information enables the teachers to customize their teaching methods in accordance with the needs of every student. AI assessment systems serve as an integral part of improving education, along with tracking students' attention AI does so much more. Giving instant feedback is just one of the ways students can be motivated to engage and go to class, it enables individual focus on student weaknesses and strengths which in turn helps guide students throughout their learning process. The use of AI solutions will ensure that assessment and monitoring in the education sector is improved. With these technologies, students will not only be monitored and assessed in real time but teachers will also have data over their history of performance, helping them improve lesson plans. With AI, there is a better learning experience as it helps create individual learning plans depending on a student's progress in a subject and with the right encouragement the goals can be achieved.

AI in Monitoring Student Behavior
- Systems that embed AI can interpret student engagement levels as well as capture student emotions. This is done using optical sensors combined with advanced vision processing technologies. The combination of both these advanced algorithms is used to ascertain the concentration level of students during lectures and binaural attention biology. This aspect of student behavior is very important for teachers because it assists them in addressing the individual needs of their students better (Pabba & Kumar, 2022; Bamunuge, 2021).
- All student metrics can be tracked over some time by AI. Once the metrics are accumulated, they can be translated in the form of graphs and speech to exemplify significant marks and patterns respectively. All such features empower teachers to gather data about students to aid informed decisions. Teachers can be timely responsive once the students are detected to have difficulties or minimal engagement. In this way, at-risk students are targeted especially for timely assistance to increase their success potential within the classroom setting. So, therefore, the fusion of AI in education will help most, indeed both, students and teachers (Pabba & Kumar, 2022).

AI in Formative and Summative Assessments
- Artificial intelligence tools focus more on efficiency improvement as well as enhancing the accuracy of educational assessments. Automation of certain integral aspects such as test administration, scoring and feedback generation for students has been enabled through these tools. Accordingly, AI reduces human involvement and thereby human error and improves assessments aiming to reflect actual student performance (Owan, 2023).

- AI-powered self-assessment such as personalized feedback is likely to improve self-evaluations and assist students with the evaluation process but it does much more than that. Such feedback enables students to recognize their strong and weak areas which is important for their academic growth. Tailored advice makes students feel accompanied in the process. This situation, in turn, gives motivation and leads to greater class attendance (Owan, 2023; Trabelsi et al., 2023). AI integration into the educational system not only improves student assessments but also enhances the overall educational experience for students and teachers.

Tailored Feedback and Student Engagement

- An increasing number of institutions are advocating for the application of educational AI systems that are designed to assist learners by tailoring their education to their needs. They seek to use the knowledge acquired from students' data to offer them a classroom experience that is useful to them. So instead of repeating the same content for each student, the system edits the curriculum based on individual student's learning patterns and their performance. Employing this strategy has high chances of optimizing students' understanding because students are more likely to use the resources that best suit their needs. Such results indicate how learners interact with the resources provided to enhance their understanding of concepts (Munyaneza et al., 2023; Martínez-Comesanã et al., 2023).
- A student's appreciation is earned when constructive messages form their strengths or weaknesses and the second and perhaps the most important strategy is giving the students different feedbacks. Such validation is useful in students' retention as well. Active attendance in the students' learning process is normally preserved, if it is obvious that they are not rewarded for giving attention only. Participation feedback plus attendance is a necessary ingredient in the student's success. When combined with individualized learning and within the right context, providing students with appropriate feedback as well as inspiration tends to increase the learning capacity of all the students (Owan, 2023; Martínez-Comesanã et al., 2023).

The implementation of a tailor-made educational approach has proven to be socially beneficial, particularly in the field of education. Despite its wide range of advantages, the practice of AI based assessing and monitoring systems has its fair share of concerns and problems. The employment of AI in modern classrooms raises important considerations of privacy and security that deserve to be addressed. The use of student's personal data also has a risk of being leaked and abused. It also raises the risk of the AI algorithms being biased towards specific groups of students which makes right to proper educational access a far-fetched possibility. All these problems have ethical implications that need to be addressed especially in AI implementation (Ahmad et al., 2023; Martínez-Comesai et al., 2023). One of the key unresolved issues has to do with the steady erosion of humanity. In instances when most learners and teachers heavily rely on the intellect of Artificial Intelligence (AI) tools, there is a chance that the crucial critical thought and problem-solving aspect may be lost. This dependence can also give rise to a sense of apathy and lethargy in learners (Ahmad et al., 2023) who can then turn to machines to complete tasks that they should be performing. To tackle these issues, it is necessary to find a balance between the use of artificial aids such as AI tools and the teacher-and-pupil roles in the educational setting. Using AI can revolutionize the education industry, but there are quite several ethical concerns that should be put in place first to ensure AI usage in the area of education. First of all, protection of student and teacher data must be enforced if such actions are being considered. Also, there is a need for human supervision of AI systems and tools so they do not bring about negative effects. Another major concern that needs to be dealt with is the absence of AI literacy amongst teachers and learners. This knowledge enables the how's and why's of AI tools, meta-learning more so it makes it easy

to know the right way to use it. There are cases where AI tools can be useful but they should be seen as a supplement to a teacher's role rather than as a replacement. Adequate use of AI tools in the classroom for example, has been found to improve engagement and more inclusiveness allowing for an engaging environment. This empowerment might in turn help address the challenges of school dropout rates, range of students and inspiring life-long learning. If ethical issues and human participation are kept in check, then education would be able to enjoy the advantages of AI without incurring the dangers associated with it.

Conclusion
The incorporation of AI in the education sector is a game changer as it empowers schools to deal with the threat of student dropouts and integrate students into learning in a completely different manner. Artificial intelligence can be a great help to educators in many ways. For example, teachers can use behavior analysis in real time to examine students in the classroom. This data can be useful in determining when a student becomes disinterested or has difficulty focusing. With the help of personalized educational systems, lessons can be tailored to the properties of an individual student maintaining the student's attention and involvement in the process. AI-based supervision systems can provide teachers with important information about regular student absence which allows providing help on time when students are likely to be in danger of losing educational progress. On the other hand, the introduction of AI in classrooms is a technological marvel which needs careful consideration and integration. This, however, is not without its challenges and one of them is ethical considerations on its use. Data privacy is a major consideration since schools should armor student data against being compromised. Algorithmic fairness is also of key importance, to ensure that AI tools do not discriminate against any student. The availability of technology should be fair for all students, so no one is disadvantaged for not being able to cope with new technological introductions. Although AI is a valuable tool, it should only be viewed in aid of the one aspect that is key in education, which is the human factor. It is important to realize that children need to be catered for by teachers and not left to thrive on their own. They are not just dispensers of information, instead, they are responsible for wielding that responsibility of being guardians and instructive figures. If AI is designed and adopted in such a manner that it is only used to support the teacher and in turn enhances the teacher's role, then the school can maintain the very important human relationships that are ideal for good learning. When education authorities embrace the use of AI in a proficient way and minimize its issues, there comes a time when such authorities will be able to utilize AI in its entirety. Consequently, Students will experience a more enriched working dimension and through. Schools will be able to minimize the key areas that restrict students from reaching their full potential due to in focus on diversity and maximize learning through personalization and support that yields better responses.

References:
Ahmad, S. F., Han, H., Alam, M. M., Rehmat, M., Irshad, M., Arraño-Muñoz, M., & Ariza-Montes, A. (2023). Impact of artificial intelligence on human loss in decision making, laziness and safety in education. Humanities and Social Sciences Communications, 10(1), 1-14.
AlAli, R., & Wardat, Y. (2024). Enhancing Classroom Learning: ChatGPT's Integration and Educational Challenges. International Journal of Religion, 5(6), 971-985.
Alkabbany, I., Ali, A. M., Foreman, C., Tretter, T., Hindy, N., & Farag, A. (2023). An experimental platform for real-time student's engagement measurements from video in stem classrooms. Sensors, 23(3), 1614.

Anand, M., Srivastava, V. K., Rayal, A., Pandey, S., Kumar, B. V., & Pachouri, V. (2023, September). Revolutionizing Mathematics Learning: Exploring the Potential of Robotics and AI as Interactive Tools for Personalized and Engaging Mathematical Education. In 2023 6th International Conference on Contemporary Computing and Informatics (IC3I) (Vol. 6, pp. 967-972). IEEE.

Anuyahong, B., Rattanapong, C., & Patcha, I. (2023). Analyzing the Impact of Artificial Intelligence in Personalized Learning and Adaptive Assessment in Higher Education. International Journal of Research and Scientific Innovation, 10(4).

Ashwini, N., Kumar, N., Nandan, M., & Suman, V. (2023). Leveraging Artificial Intelligence in Education: Transforming the Learning Landscape. International Research Journal of Computer Science, 10(05), 192-196.

Bamunuge, H. K. T., Perera, H. M., Kumarage, S., Savindri, P. A. P., Kasthurirathna, D., & Kugathasan, A. (2021, December). E-Learn Detector: Smart Behaviour Monitoring System to Analyze Student Behaviours During Online Educational Activities. In 2021 3rd International Conference on Advancements in Computing (ICAC) (pp. 19-24). IEEE.

Dong, W., Pan, D., & Kim, S. (2024). Exploring the integration of IoT and Generative AI in English language education: Smart tools for personalized learning experiences. Journal of Computational Science, 82, 102397.

Dong, Z., An, J., & Liu, L. (2023, December). Leveraging Emotion Recognition for Enhancing Arts Education: A Classroom Behavior Analysis Approach. In Proceedings of the 2023 International Conference on Information Education and Artificial Intelligence (pp. 212-217).

Dukić, D., & Sovic Krzic, A. (2022). Real-time facial expression recognition using deep learning with application in the active classroom environment. Electronics, 11(8), 1240.

Fernández Herrero, J., Gómez Donoso, F., & Roig Vila, R. (2023). The first steps for adapting an artificial intelligence emotion expression recognition software for emotional management in the educational context. British Journal of Educational Technology, 54(6), 1939-1963.

Gupta, S., Kumar, P., & Tekchandani, R. (2023). A multimodal facial cues based engagement detection system in e-learning context using deep learning approach. Multimedia Tools and Applications, 82(18), 28589-28615.

Harry, A. (2023). Role of AI in Education. Interdiciplinary Journal and Hummanity (INJURITY), 2(3), 260-268.

Khuntia, A., & Kale, S. (2024). Real Time Emotion Analysis Using Deep Learning for Education, Entertainment, and Beyond. arXiv preprint arXiv:2407.04560.

Li, L., Chen, C. P., Wang, L., Liang, K., & Bao, W. (2023). Exploring artificial intelligence in smart education: Real-time classroom behavior analysis with embedded devices. Sustainability, 15(10), 7940.

Charles, F. (2023). AI-powered personalized mobile education for New Zealand students. International Journal Software Engineering and Computer Science (IJSECS), 3(1), 33-39.

Llurba, C., Fretes, G., & Palau, R. (2022). Pilot study of real-time Emotional Recognition technology for Secondary school students. IxD&A, 52, 61-80.

Martínez-Comesaña, M., Rigueira-Díaz, X., Larrañaga-Janeiro, A., Martínez-Torres, J., Ocarranza-Prado, I., & Kreibel, D. (2023). Impact of artificial intelligence on assessment methods in primary and secondary education: Systematic literature review. Revista de Psicodidáctica (English ed.), 28(2), 93-103.

Munyaneza, M. A., Gasana, J. M., Uwimana, J., Shumbusho, J. P., Nzayisenga, J., Gafeza, G., & Niyonzima, M. (2023). IoT and AI Based Student's Attendance Monitoring System to Mitigate the Dropout in Non-boarding Secondary Schools of Rwanda: A Case Study of Wisdom School Musanze. European Journal of Technology, 7(1), 27-43.

Owan, V. J., Abang, K. B., Idika, D. O., Etta, E. O., & Bassey, B. A. (2023). Exploring the potential of artificial intelligence tools in educational measurement and assessment. Eurasia Journal of Mathematics, Science and Technology Education, 19(8), em2307.

Pabba, C., & Kumar, P. (2022). An intelligent system for monitoring students' engagement in large classroom teaching through facial expression recognition. Expert Systems, 39(1), e12839.

Pendy, B. (2021). Artificial intelligence: The future of education. Journal of Indonesian Social Sciences, 2(11).

Sadykova, F., E. (2023). Personalization of learning in programming on the example of the application of internet services. Informatics and education. 37. 62-68. Doi: 10.32517/0234-0453-2022-37-6-62-68.

Tiwari, R. (2023). The integration of AI and machine learning in education and its potential to personalize and improve student learning experiences. Indian Scientific Journal of Research In Engineering And Management, 07(02). doi: 10.55041/ijsrem17645

Trabelsi, Z., Alnajjar, F., Parambil, M. M. A., Gochoo, M., & Ali, L. (2023). Real-time attention monitoring system for classroom: A deep learning approach for student's behavior recognition. Big Data and Cognitive Computing, 7(1), 48.

Yin Albert, C. C., Sun, Y., Li, G., Peng, J., Ran, F., Wang, Z., & Zhou, J. (2022). Identifying and Monitoring Students' Classroom Learning Behavior Based on Multisource Information. Mobile Information Systems, 2022(1), 9903342.