

AI in Biology Learning: Analysis of Students' Personal Needs for Differentiated Learning in the Social Society 5.0 Era

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ABSTRACT

AI in education is increasingly being used in the social society 5.0 era. In the teacher community, there are those who agree and disagree with the use of AI in learning, but it cannot be denied that the presence of AI is a profitable innovation for teachers. Teachers need to collaborate with AI technology without changing the essence of a teacher's presence in understanding students' personal needs. Identification of students' personal needs is needed in differentiated learning, including biology learning. Differentiated biology learning provides more student contributions by maximizing students' abilities to develop optimally and meaningful learning is achieved. This research aims to conduct a literature analysis study to describe the use of AI in identifying student needs to support differentiated learning in biology learning. This research uses a qualitative literature review research method by analyzing 12 research journals related to the use of AI in identifying student needs in differentiated biology learning. From the results of the analysis, AI provides many benefits in identifying students' needs in biologically differentiated learning, including in preparing flexible learning plans, analyzing academic data, personalized learning materials, analyzing learning styles and preferences, early identification and intervention, providing personalized feedback, collaboration and social learning, integrating external resources, student feedback and reflection, personalized learning experiences, so it is very helpful in identifying student needs.

Keywords: A (Artificial Intelligence), students' personal needs, differentiated learning, biology learning, social society 5.0.

1) INTRODUCTION

AI (artificial intelligence) is becoming an increasingly relevant topic along with the development of technology that marks the era of social society 5.0. The development of technology, especially in the field of artificial intelligence or AI, has a huge impact on various aspects of life. AI itself is the ability of machines or software to perform tasks that previously could only be performed by humans, such as learning, reasoning, and perception (De la Vega, 2023). Artificial intelligence (AI) is a computer programme designed and built to mimic human intelligence, including decision-making ability, logic, and other characteristics of intelligence

(Karyadi, 2023). AI has the ability to perform various tasks that generally require human intelligence, such as speaking, hearing, seeing, learning, thinking, and solving problems. AI can also be applied in various systems, including web search, voice recognition, face recognition, language translation, recommending products, data analysis, and graphic arts generation (Yulianto & Suryana, 2018). The ability of Artificial Intelligence to process and analyse data faster and more efficiently than humans is the main reason why this technology is increasingly in demand and used in various fields, including in education (Suciati et al., 2023).

AI is one of the characteristics of the development of the 5.0 era which of course has an impact on education. The developing technology must be utilised properly and responsibly, which in this case requires the role of educators to be more dynamic and innovative. Teachers in this context must master data, technology and human literacy, and have 21st century skills such as leadership, digital literacy, communication, emotional intelligence, entrepreneurship, global citizenship, teamwork and problem solving. 21st century education in the digital era is a challenge for teachers as educators. As the frontline in education, teachers have the responsibility to create learning that aims to improve the abilities or skills needed by a person to survive. Teachers must create innovative and creative learning, especially in learning with this independent curriculum, which refers to creativity and effective learning (Handayani et al, 2024). Artificial Intelligence can be utilised to help improve the quality of learning and develop students' potential, including in the field of creativity (Gulamhussein, 2013). Creativity is one of the important aspects in education that can help students to develop new ideas, explore ideas, and produce innovative solutions (Sucahyo et al., 2023).

In an effort to face the challenges of the Society 5.0 era, educators must utilise technologies such as the Internet of Things (IoT), virtual/augmented reality in learning, and artificial intelligence (AI) to identify students' learning needs (Amelia, 2023). Schools and education personnel have an important role in society 5.0. Learning activities do not only focus on one source such as books, but educators are evolving to receive information from various sources such as the internet and social media. The use of digital media requires more insight from educators, therefore the role of schools and educators is very important in society 5.0 which focuses on human labour. Educators in the Society 5.0 era are expected to be learning facilitators that enable students to develop skills (Amelia, 2023). The utilisation of technology in learning is also intended for students to gain meaningful learning. Meaningful learning is carried out by utilising digital

media so that students gain many learning experiences through their five senses. In the field of education, the presence of artificial intelligence, mixed reality, augmented reality and virtual reality gave rise to a learning method termed by various experts in the field of education as immersive learning, learning to include environmental simulation to realise a better inspiring and more meaningful learning experience for students (Agusta, et al, 2022). Meaningful learning can be achieved by identifying the personal needs of each student.

Identification of students' personal needs is an effort made by teachers in recognising the situation that occurs in the learning process, comparing it with the desired and needed learning situation according to student characteristics (Magdalena, Marchani, & Mariana, 2023). The activity is used to distinguish students' preferences and needs for subject matter as the basis for implementing differentiated learning (Lisnawati, Kuntari, & Hardiansyah, 2023). This learning personalisation process requires significant efforts, including a deep understanding of students' needs and the ability to deliver learning materials individually.

The journal consists of several main sections: literature review, research methodology, data analysis, and results. Each section supports the main argument that in this 5.0 era, learning by utilising digital media is a must in order to create meaningful learning experiences and quality human resources. Teachers can utilise technologies such as Internet of Things (IoT), virtual/augmented reality in learning, and artificial intelligence (AI) to identify students' learning needs. AI's ability to analyse data is faster than humans so the use of AI greatly facilitates the process of learning activities. This research not only offers solutions to existing problems, but also paves the way for educators to develop more innovative and inspiring approaches to learning by utilising AI technology.

2) METHODS

This research is a qualitative research. In Sugiyono's book (2021), qualitative research deals with non-numerical data, collecting and analyzing narrative data. The research method used is qualitative research using a library approach, namely studies that use data analysis based on written material. Library materials include published notes, books, magazines, newspapers, manuscripts, journals or articles (Firmansyah, 2021). This study uses 12 articles from *sinta* and *scopus* accredited journals that are in accordance with the theme raised, namely the use of AI in

identifying students' personal needs. Data validity was ensured through the selection of literature sources relevant to the research theme, and data selection and verification were carried out to ensure accuracy and validity. The validity of this research is supported by reliable references, which come from educational and academic sources.

3) RESULTS AND DISCUSSION

Artificial intelligence (AI) technology is one of the most popular innovations today. AI is a computer system that can perform human tasks (Zhang, 2021). Many positive impacts are seen as a result of the use of AI in education, namely the ability of AI to help educators provide education that suits the needs of students (Futterer et al., 2023). Another impact is the improvement of learning quality (Wang, 2023). In biology learning, AI can be used to analyse student needs in differentiated learning in the era of social society 5.0, among others:

1. Flexible Lesson Plan Development

In a research journal entitled 'Revolutionising education with AI: Exploring the transformative potential of ChatGPT'. In this study, the main focus was on chatbots that are able to simulate human reactions by analysing algorithms that enable chatbots to generate human-like text based on natural language input, with applications in educational settings. The results show that AI can provide support for teachers in developing flexible lesson plans by considering student data, which includes adjusting materials, methods and assessments according to student needs. During the learning process AI automatically adjusts the lesson plan based on student progress and timely feedback (Adiguzel, T., Kaya, M. H., & Cansu, F. K, 2023).

2. Personalised Learning Materials

In a research journal entitled 'Relevance, Effort, and Perceived Quality: Language Learners' Experiences with AI-Generated Contextually Personalised Learning Materials'. Researchers developed one personalised version of a mobile language learning app with two non-personalised crowdsourced versions, (1) with automatically generated and personalised photo flashcards, (2) the same flashcards provided through crowdsourcing, and (3) manually generated flashcards based on the same photos. The results of this study show that learners rated the quality of the automatically generated and non-personalised materials as equivalent to the manually generated materials, which means that automatic generation is feasible. So that

AI can recommend materials that meet the needs of students (Fiona, Draxler., Albrecht, Schmidt., Lewis, L., Chuang, 2023).

3. Personalised learning experiences

In the journal entitled 'Generative AI for Customisable Learning Experiences' researchers developed a tool that integrates with the learning management system that previously existed in software engineering colleges. The designed tool automatically generates learning materials based on specific learning outcomes provided by professors for their classes. This method allows for personalisation of educational content tailored to student needs. The results of this study generated learning materials with variants that appealed to students, especially different learning styles presented with a traditional professor style and a version influenced by pop culture that made the learning process more enjoyable. Students showed positive acceptance of the concept of customisable learning experiences (Ivica et al., 2024)

4. Learning Styles and Preferences Analysis

In a journal entitled 'A Review on Artificial Intelligence in Education' researchers analysed specific applications of AI technologies, such as image recognition, prediction systems, and computer vision, in educational settings. The authors then illustrate how AI can improve the quality of teacher teaching and student learning methods. By utilising AI technologies, educators can adopt more diverse and personalised teaching strategies, thus meeting the unique needs of each student. The results show that AI can contribute to making students' learning styles more diverse and personalised. This adaptability is essential to address the diverse preferences and needs of learners, ultimately resulting in a more engaging educational experience (Jiahui, Huang., Salmiza, Saleh., Yufei, Liu. (2021)

5. Provision of Personalised Feedback

In a journal entitled 'Artificial Intelligence in Education: A Review'. The results showed that AI can provide instant and personalised feedback based on student performance in exercises and assessments. This feedback can include suggestions for improvement and additional resources for schools. Researchers also explained that AI can analyse the feedback given to students to ensure that it is useful and appropriate to their needs (L. Chen, P. Chen and Z. Lin, 2020).

6. Integrating External Resources

In a journal entitled 'AI in personalised learning'. The results of this study show that AI can identify and provide relevant external resources, such as scientific articles, learning videos, or interactive modules, based on students' interests, preferences, and skill levels, creating a more customised and immersive learning experience. However, the study also explained that the use of AI encounters many challenges, including privacy concerns, ethical considerations, and potential bias in AI algorithms (Kuldeep et al., 2024).

7. Academic Data Analysis

In a journal entitled 'The Impact of Statistics and Probability on Educational Artificial Intelligence'. It reported that AI plays a transformative role in analysing student academic data. With AI the results of assessments and quizzes carried out in class can be identified error patterns or areas where students are having difficulty. This role will help teachers understand the strengths and weaknesses of each student. The research also explains that AI can monitor students' academic progress in real-time, providing insights into whether they understand the material or need additional help (Rosales, 2024).

8. Collaboration and Social Learning

In a journal entitled 'Enhancing Social Engagement among Online Learners Using AI-Driven Tools: National Open University of Nigeria Learners' Perspective', shows the results that collaboration and social learning in educational environments have utilised the important role of AI. The research shows that AI-driven tools, such as personalised learning systems and chatbots significantly enhance social engagement among online learners (Ezeanya et al. 2024). In addition, the journal entitled 'Using social learning theories to explore the role of generative Artificial Intelligence (AI) in collaborative learning' shows the results that generative AI supports collaborative learning and facilitates shared knowledge through student interaction in group activities or online discussions to identify group dynamics and provide insight into how students collaborate. So that AI can recommend study groups or collaborative projects that can improve students' social and academic skills (Xue, Zhou., Lilian, N., Schofield, 2024).

9. Early Identification and Intervention of Students

In a journal entitled 'Artificial Intelligence (AI) Towards Students' Academic Performance'. The researcher examined the impact of artificial intelligence (AI) towards students' academic performance, focusing on several factors such as student performance improvement, attitude

towards learning, motivation, study habits, and learning mechanisms. Using mixed methods, including FGDs to collect qualitative and quantitative data. The results show that AI effectively focuses on students' specific learning needs, and facilitates a comprehensive learning experience. It can thus identify students who are experiencing difficulties and provide the necessary interventions and support to improve their academic performance. The early intervention that AI can provide supports students to predict difficulties they may experience in the future (Leovigildo&Mallillin, 2024).

10. Student Reflection

In the journal entitled 'Artificial intelligence in biology and learning biology: A literature review', researchers conducted a literature review to analyse and synthesise research results from a new perspective. The researchers found that there are various applications of AI in biology education, including personalised learning and assessment tools, that can support students' reflective practice about learning so that students can identify understanding and areas that need further support. (Ipin, Aripin., Aden, Arif, Gaffar., Muhammad, Barin, Abdul, Jabar., Dwi, Yulianti, 2024).

While in another journal entitled 'Using artificial intelligence to create biology multiple choice questions for higher education' researchers conducted a study with the aim of knowing the validity, reliability, difficulty level, and discrimination power of a collection of college biology questions generated by artificial intelligence (AI). A sample of 272 students was selected using a random sampling technique to answer a series of multiple choice questions and fill out a questionnaire. The researcher obtained the results that 20 out of 21 questions generated by ChatGPT AI were valid. Cronbach's alpha coefficient was set at 0.65 (moderately reliable) for the twenty valid questions. Based on students' responses to the questions generated by the ChatGPT AI, it was determined that 79% of students stated that the AI-generated questions were relevant to the subject of the class. 72% of students reported that the clarity of the AI-generated questions was acceptable. 73% of students reported that the accuracy of AI-generated questions was good. The results of this study suggest that AI can effectively assess student understanding and encourage reflection on learning content. (Nanda, Eska, Anugrah, Nasution, 2023)

The integration of Artificial Intelligence (AI) in biology learning, particularly focusing on differentiated learning to meet students' personal needs, is an important aspect of education in the

Society 5.0 era. The use of AI enables personalised learning experiences. This is particularly useful in biology learning where students have different learning styles and needs. AI can help identify students' strengths and weaknesses (Gligorea, et al., 2023), thus customising teaching to meet the needs of individual students (Luckin, Cukurova, Kent, & du Boulay, 2022). Differentiated teaching is essential in biology learning as it ensures that all students, regardless of ability, have access to the learning that is taking place. AI can facilitate this by providing adaptive learning systems that adjust the content and pace of instruction (Luckin, Cukurova, Kent, & du Boulay, 2022), based on student performance and learning styles (Sembiring, Yusuf, Sadikin, Mursyd, & Hendra, 2024).

From the above statement and also analysis of previous studies, the author concludes that AI in biology learning is able to facilitate the needs of students in learning biology. The existence of AI provides many benefits for students in personalising their learning. The existence of AI also makes learning more flexible because it can adjust to students' learning styles, abilities, and interests, in addition to collaborative learning that increases interaction between students. Students' personalised needs for differentiated learning are increasingly shaped by the integration of technology and the demand for competence. As technology is highly integrated into daily life, AI plays a vital role in improving education. The goal is to create a society where technology supports human well-being and social sustainability. Educators must be AI-ready to utilise technology effectively, thus ensuring students are future-ready (Sherly, Chandra, Sisca, Efendi, & Dharma, 2023; Oktavian, Aldya, & Arifendi, 2023). In a research journal entitled 'Bridging Society Transformation in the Era of Society 5.0' researchers found that the integration of advanced technology and academic expertise has brought significant progress in community empowerment, the results of which can be used for a sustainable society that is resilient and able to thrive amid the dynamics of society 5.0 (Nur'aina, Amane, & Laali, 2024). In another research journal entitled 'Generation multiculturalism in the era of society 5.0' researchers found that Society 5.0 in the multicultural era focuses on digital transformation, emphasises the quality of human resources, digital literacy, and the important role of Indonesia's golden generation in growing a complex and dynamic society (Citra, 2024).

From this research, it can be concluded that in society 5.0 the integration of advanced technology and academic expertise brings significant progress in community empowerment which focuses on digital transformation and digital literacy to foster a complex and dynamic society that

is able to face the times. While in a research journal entitled ‘The Impact of Society 5.0 on Curriculum Development in Higher Education’ the researcher's aim is to explore society 5.0 and the need for a human-centred approach as well as significant challenges in educational reform. The researcher found that society 5.0 integrates the physical and virtual worlds using advanced technology for the betterment of society. It thus emphasises human well-being, technological literacy, ethics, and interdisciplinary education in higher education for future readiness (De Villiers, 2024). So it can be concluded that society 5.0 which focuses on digital transformation and digital literacy integrates the physical world and the virtual world by using advanced technology for the advancement of society and with this technology, the need for ethics in its use.

From the research that has been conducted with the analysis of various relevant sources, it is found that in biology learning AI can analyse the personal needs of students in differentiated learning in society 5.0. With the help of AI, it can provide support for teachers in developing flexible learning plans by considering student data, which includes adjusting materials, methods and assessments according to student needs. AI also supports personalised learning by recommending materials that suit students' needs. With AI, students have a personalised learning experience that allows for personalisation of educational content tailored to student needs. Analysing learning styles and preferences, AI contributes to making students' learning styles more diverse and personalised. This adaptability is essential to address the diverse preferences and needs of learners, ultimately resulting in a more engaging educational experience. Similarly, by providing feedback, integrating external resources, analysing academic data, enhancing collaboration and social learning among students, AI can recommend study groups or collaborative projects that can improve students' social and academic skills as well as early identification and intervention of students, reflecting on students' late learning. Of course, this is inseparable from the rapidly growing technological transformation in society, whose role is controlled by academics as agents of change. Society 5.0 focuses on digital transformation and digital literacy which is always growing complex and dynamic, and holds some ethics in its use. Therefore, AI is very effective to be used in biology learning in facilitating students' personal needs in learning in society 5.0.

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