

Adaptive Learning Based on Artificial Intelligence to Overcome Student Academic Inequalities

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ABSTRACT

Background. In the context of higher education, academic inequality is a serious obstacle in achieving equitable learning outcomes among students. Factors such as educational background, learning styles, and differences in mastery of material are the main triggers for this inequality. To overcome this challenge, innovative approaches such as adaptive learning based on Artificial Intelligence (AI) have emerged as a potential solution.

Purpose. This research aims to investigate the potential of AI-based adaptive learning in overcoming academic inequality among students. By combining AI technology, this research seeks to provide personalized solutions tailored to each student's learning needs.

Method. This research uses quantitative methods with a survey model. A total of 20 respondents were selected representatively to provide their views on learning experiences, preferences and views regarding adaptive learning. This survey provides relevant data to understand whether the implementation of AI-based adaptive learning can be considered an effective measure to reduce academic inequality.

Results. The research results show that the majority of respondents face difficulties in understanding course material in general. However, most also expressed openness to the use of AI-based adaptive learning. This positive perception can be an indication of the potential success of implementing this technology as a solution to overcome academic inequality.

Conclusion. Taking into account the research results, AI-based adaptive learning is promising as a solution that can align the learning needs of individual students. Although implementation challenges remain, this research provides initial impetus for further exploration of the application of AI technologies in achieving academic equity in higher education settings.

KEYWORDS

Academic Inequalities, Adaptive Learning, Artificial Intelligence.

INTRODUCTION

Education is considered the main pillar in efforts to develop quality human resources (Tektonidou et al. 2019). Although higher education promises prestige and

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opportunity, a reality that cannot be ignored is the existence of academic inequality among students (Engzell, Frey, and Verhagen 2021; Day et al. 2021). This inequality is the impact of various complex factors, including differences in educational backgrounds, learning styles, and levels of mastery of material. This diversity not only creates challenges in achieving equitable academic outcomes, but also raises fundamental questions about how to increase accessibility and equality in higher education environments (Ge et al. 2022).

as an increasingly profound issue when students with diverse Academic inequality emerges educational backgrounds enter the classroom the same one (Dicataldo, Florit, and Roch 2020). This challenge is unique because it creates complex dynamics in developing learning strategies that can respond to the diverse needs of all students. Limited understanding, varied learning styles, and difficulties in following the curriculum are the main triggers for this inequality problem (Feniger 2020; Tiwari et al. 2022). The implications are not only felt in terms of academic achievement alone, but also have a significant impact on the motivation and overall well-being of students in higher education environments (Son et al. 2020; Shafique et al. 2020).

This inequality phenomenon becomes increasingly complex when it involves students from different socioeconomic backgrounds (Murray et al. 2020). different, heterogeneous educational experiences, and a diversity of learning styles. This diversity, although a wealth, is often a source of inequality that requires special attention in designing educational policies and developing learning methods (Wang et al. 2020; Ye et al. 2022). Therefore, to create an inclusive and equitable educational environment, serious efforts need to be made to understand, identify and address the root causes of academic inequality.

Adaptive learning is an approach that responds to individual learning needs, allowing each student to follow the curriculum according to their level of understanding (Jackson and Collins 2019). It is hoped that the implementation of AI in this context can be an answer to the complexity of academic inequality among students (Saribatur, Eiter, and Schüller 2021).

Why do we need to discuss this problem? First of all, academic inequality can be a major obstacle to achieving a vision of inclusivity and equality in the world of higher education. Through this discussion, it is hoped that solutions will emerge that can advance the principles of equality and provide equal access to education for all students, regardless of their background.

AI-based adaptive learning emerges as a promising solution (Dou et al. 2023). The combination of artificial intelligence with personalized learning could be the key to addressing academic inequality (Sinha et al. 2022). This technology allows automatic learning adjustments based on each student's abilities and learning needs. Thus, this solution provides space for the development of learning models that can minimize existing academic gaps (Xiao and Cooke 2019; Akbarieh et al. 2020).

Why do we need to do this research? This research was conducted to bridge the gap in the literature regarding AI-based adaptive learning for tertiary level students. So far, no research has explicitly explored this potential solution to academic inequality. Therefore, this research creates innovation and unique contributions by utilizing the latest AI technology to design learning approaches that can minimize inequality among students.

This research aims to make a significant contribution in developing understanding of the potential of AI-based adaptive learning as a solution to academic inequality (Visseren-Hamakers et al. 2021). Through the integration of survey data from 20 respondents, we can identify the extent of acceptance and effectiveness of adaptive learning among students. In addition, this research involves the use of the latest AI technology and presents the state of the art in understanding how

these developments can be applied effectively in higher education environments (Brown et al. 2022).

The innovation of this research lies in the development of an adaptive learning model that can be tailored to individual student learning needs (Savchenko, Savchenko, and Makarov 2022). This research will utilize quantitative survey methods to collect data, enabling an in-depth assessment of students' perceptions, needs, and readiness for AI-based adaptive learning.

Previous research has explored the application of artificial intelligence (AI) technology in education, covering aspects such as adaptive learning, teaching evaluation, and virtual classrooms (Tang, Chang, and Hwang 2023). The results show a positive impact on teachers' teaching levels and the quality of student learning. However, several challenges arise, such as teachers' lack of understanding of new technologies, privacy concerns, and infrastructure availability (Butun, Osterberg, and Song 2020). This literature study provides important insights to support the development of AI in education, providing a foundation for sustainable and targeted education reform.

Furthermore, previous research has investigated the application of artificial intelligence (AI) technology in educational contexts as a result of rapid developments in AI technology. Various applications of AI in education, such as adaptive learning, smart campus, teacher evaluation, smart tutor robots, and virtual classrooms, have been explored in this article. After evaluating the impact of AI technology on teaching and learning, it was concluded that AI had a positive effect on the quality of instruction provided by teachers and student learning outcomes. Ultimately, the article discusses the potential challenges that AI applications in education may face, while highlighting the possible role of AI in helping schools improve the quality of education and, therefore, driving educational reform (Liu, Li, and Nie 2022; Azorín and Ainscow 2020).

This subsequent previous research explores the field of artificial intelligence (AI) studies that combine the applications of machine learning, algorithm production, and natural language processing (Chen et al. 2020). AI applications have transformed educational tools with a wide range of applications, such as personalized learning platforms to enhance students' learning experiences, automated grading systems to assist teachers, and facial recognition systems to generate insights into learner behavior (Brink et al. 2022). Despite the potential benefits of AI in supporting student learning experiences and teacher practices, the ethical and social impacts of these systems are rarely fully considered in the context of K-12 education. The ethical challenges of AI in education need to be identified and introduced to teachers and students (Kasneci et al. 2023). To address this issue, this research (1) briefly defines AI through the concepts of machine learning and algorithms; (2) introduce AI applications in educational settings and the benefits of AI systems to support student learning processes; (3) explain the ethical challenges and dilemmas of using AI in education; and (4) addresses the teaching and understanding of AI by providing recommended instructional resources from two providers, namely MIT Media Lab and Code.org. This article aims to help practitioners reap the benefits and overcome the ethical challenges of AI integration in K-12 classrooms, while also introducing instructional resources that teachers can use to increase K-12 students' understanding of AI and ethics.

From the three previous studies that have been described, it can be concluded that the application of artificial intelligence (AI) technology in education has had a positive impact on teaching and learning methods (Kaur et al. 2023). First research shows that AI has the potential to improve the quality of learning with adaptive learning and intelligent teaching evaluation. The second study looked at the positive benefits of AI in addressing academic inequalities among students through adaptive learning. Meanwhile, a third study underscores the need to understand

and address the ethical and social impacts that may result from implementing AI in K-12 education. Overall, this research provides a foundation for better understanding the potential, challenges, and solutions in integrating artificial intelligence in an educational context (Zaguia et al. 2021).

The main goal of this research is to produce an AI-based adaptive learning model that can be implemented in higher education institutions (Silva et al. 2023). By utilizing survey results and data analysis, this research aims to evaluate the effectiveness and student acceptance of the proposed learning model.

By developing a rationale through this discussion, it is hoped that innovative solutions can be found to overcome academic inequality. It is hoped that this research contribution will be able to open new avenues for thought and change in the development of inclusive and adaptive high-level learning systems. With this hope, this research is an important first step towards achieving a vision of more equitable and sustainable education.

RESEARCH METHODOLOGY

This research adopts a quantitative survey method with the aim of in-depth analysis of students' perceptions and experiences of artificial intelligence-based adaptive learning as a response to academic inequality (Dey et al. 2020; Zaman et al. 2022). In this approach, research prioritizes the use of questionnaires as the main instrument for collecting data from respondents. This research design follows a survey model using a questionnaire. The questionnaire was designed by considering research variables which include aspects such as understanding, satisfaction, and effectiveness of adaptive learning.

The population of this research is students from various educational backgrounds and academic levels. In random purpose sampling, 20 students were selected as respondents who would fill out the questionnaire. The questionnaire was carefully designed to cover all dimensions relevant to the research objectives (Etim et al. 2021). Questions were asked in both closed and open formats to allow for variation in responses. Respondents were selected randomly through purpose sampling. After identification, they were given information about the purpose of the study and instructions for filling out the questionnaire. Questionnaires are distributed to respondents either online via an online platform or offline at scheduled locations (Sallam et al. 2021). The questionnaire was collected after respondents had filled it out according to the guidelines.

Before filling out the questionnaire, participants were given an in-depth explanation of the research objectives and gave voluntary consent. Respondents' identities are kept confidential, and research results will not directly identify individuals. Data is processed without including personal information. The main technique used in this research is data collection through questionnaires. The questionnaire was used to obtain quantitative responses from respondents regarding their perceptions of artificial intelligence-based adaptive learning (Koc and Gurgun 2022; Lee and Yeo 2022).

By focusing on analyzing data obtained from the questionnaire results, this research is expected to provide in-depth insight into students' views of artificial intelligence-based adaptive learning. In understanding academic inequality, questionnaire data analysis is considered a powerful tool for exploring and describing respondents' experiences and perceptions related to adaptive learning solutions.

RESULT AND DSCUSSION

To understand the importance of academic problems among students, researchers distributed a questionnaire to 20 respondents with the question I believe that academic inequality is a significant problem among students? With the following results:

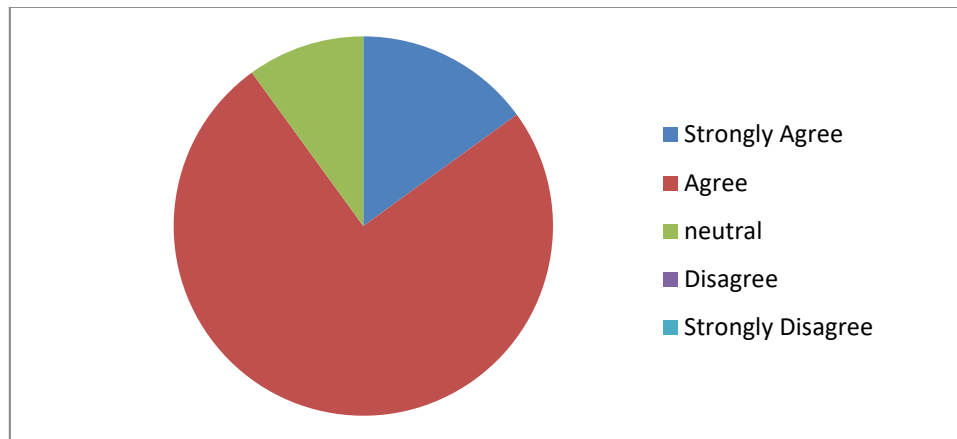


Figure 1. Academic inequality is a significant issue among students

From the results of the answers from 20 respondents to questions regarding beliefs about the significance of academic inequality among students, it can be presented as follows: Strongly Agree: 3 people (15%), Agree: 15 people (75%), Neutral: 2 people (10%), Disagree: 0 people (0%) Strongly Disagree: 0 people (0%) Based on this data, the majority of respondents (90%) agreed or strongly agreed that academic inequality is a significant problem among student. The high percentage of the 'Agree' option indicates a strong consensus among respondents about the importance of the issue. Although there is slight uncertainty (neutral) from a small number of respondents, it can be concluded that the majority of respondents view academic inequality as a problem worthy of attention.

Next question I prefer to learn in a certain way (eg: visual, auditory, practical).? The following answer results were obtained:

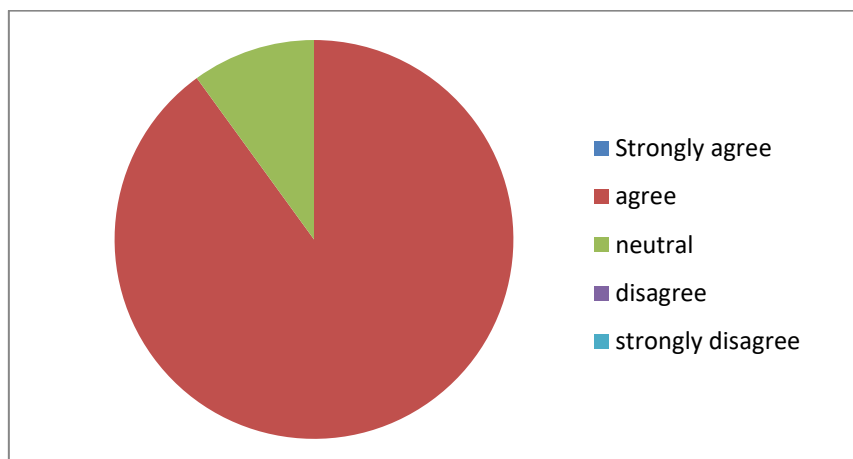


Figure 2. How to learn in a certain way

Based on the answers from 20 respondents to questions regarding preferences for learning in certain ways, the majority of respondents showed a positive tendency towards specific learning preferences. Of the total respondents, 18 people or 90% said they agreed, while 2 people or 10% answered neutral.

It can be concluded that most respondents tend to have certain preferences in the way they learn, be it through visual, auditory or practical methods. This positive tendency may reflect the need for individuality in the learning process, where some people may feel more comfortable or effective learning through certain methods compared to others.

However, it should be remembered that the 10% of respondents who answered neutral indicates variations in learning preferences among participant. This can be caused by various learning styles and individual preferences that must be taken into account in the educational context. These conclusions can provide valuable insights for the development of learning strategies that are more inclusive and responsive to the diverse learning needs among students.

Next question I find it difficult to understand lecture material in general? From this question we can see the results as follows:

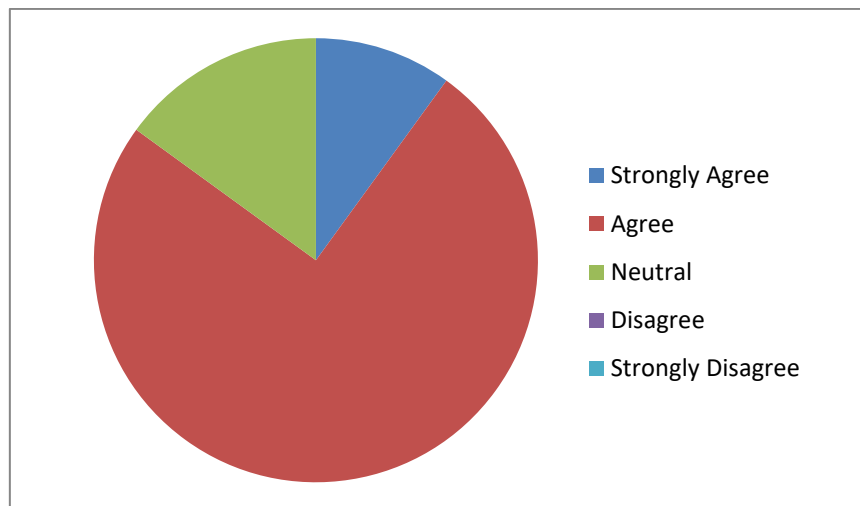


Figure 3. Difficulty understanding lecture material in general

Through analysis of answers to questions regarding difficulties in understanding lecture material, the results show that there are a number of respondents who face challenges in understanding the material. As many as 50% of the total respondents agreed or strongly agreed that they found it difficult to understand lecture material in general. This figure illustrates that the majority of participants experienced challenges in overcoming the complexity of academic material. Even though there was a small number of respondents who chose the neutral option, this statement can be interpreted as an indication of individual variation in students' experiences with understanding course material. Factors such as learning styles, level of difficulty of the material, and teaching methods may play a role in creating these differences.

The importance of recognizing the difficulties faced by some students is an important basis for improving learning (Adams and Myran 2022). By understanding these pain points, educational institutions can develop more responsive learning strategies, such as the use of diverse teaching methods, the use of assistive technology, or increased tutor and mentor support. Therefore, these results provide a valuable basis for further discussion about improving and developing learning methods to increase understanding of lecture material among students.

The next question, Do you believe that the implementation of AI-based adaptive learning can provide a solution to overcome academic inequality? With the following answer:

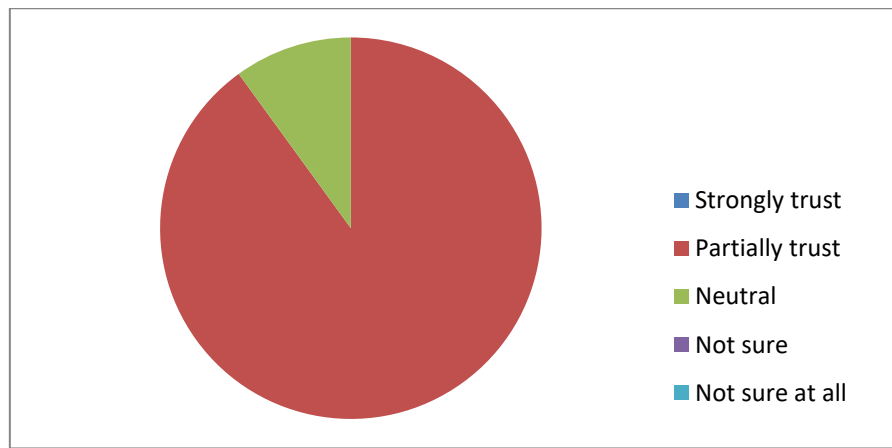


Figure 4. The implementation of AI-based adaptive learning can be a solution to overcome the academic gap

From the results of the answers to the question regarding confidence in the implementation of AI-based adaptive learning as a solution to overcome academic inequality, a fairly optimistic picture is drawn. Of the 20 respondents, the majority, 80%, stated that they partially believed in the potential of this solution. Although no one has expressed complete confidence (strongly believe), the existence of the partial confidence option gives an indication that the majority of respondents see the implementation of AI-based adaptive learning as one of the feasible solutions to overcome academic inequality (Gusev and Bondarko 2020).

It is important to note that there are 20% of respondents who stated neutral, indicating variation in perceptions of this solution among participants. This could be due to a number of factors, including their level of understanding of AI technology, exposure to adaptive learning, or perhaps skepticism of its effectiveness. Therefore, these results highlight the importance of further education and outreach regarding the benefits and applications of AI technology in supporting academic equality.

Although no one expressed distrust (not sure or not at all), further understanding of respondents' needs and concerns is neutrality can be a basis for developing better implementation strategies. These conclusions provide the basis for a deeper discussion of how AI-based adaptive learning can be effectively integrated to address academic inequities and ensure that these solutions embrace the diversity of student views and needs (Handelman et al. 2022).

Final question Would you be willing to try AI-based adaptive learning if it were available in your learning environment? With the following respondent results:

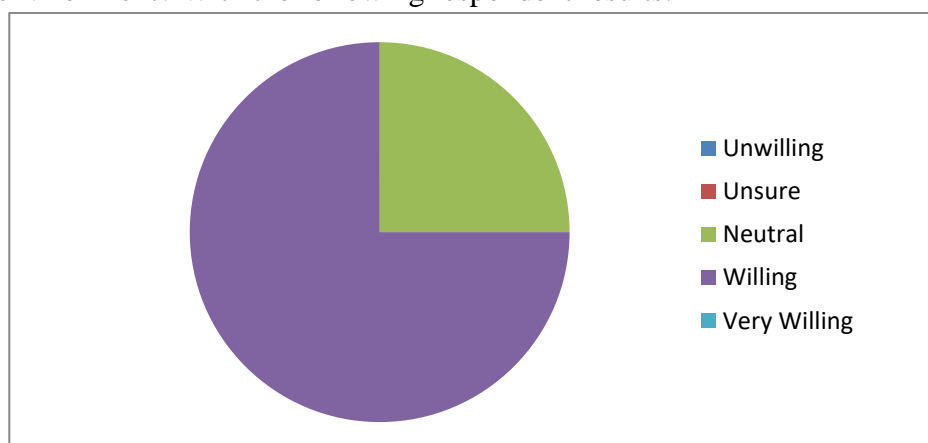


Figure 5. Willingness to try adaptive learning based on AI learning environment

Based on the results of the answers from 20 respondents to the question about readiness to try AI-based adaptive learning if it is available in the learning environment, it can be concluded that the majority of respondents show readiness and enthusiasm for the use of this technology. Of the total respondents, 75% said they were willing, while 25% chose the neutral option.

The majority of respondents who were willing to try AI-based adaptive learning (75%) reflects a positive level of acceptability towards the integration of advanced technology in the learning process. This can be interpreted to mean that the majority of students see positive opportunities in using AI-based adaptive learning to enhance their learning experience.

Even though there is a small portion of respondents who chose the neutral option (25%), this can be taken as an indication that there is a difference in the level of readiness or interest in this technology among respondents. Factors such as level of technological understanding, learning preferences, or belief in the effectiveness of AI-based adaptive learning may play a role in respondents' decisions.

Thus, the conclusion from these results illustrates that the majority of students in this research sample are willing to adopt AI-based adaptive learning if implemented in their learning environment, while a small number are still considering or have not yet made a firm decision regarding their readiness.

CONCLUSION

From the results of data analysis of five questions asked to 20 respondents related to academic inequality, learning preferences, difficulty understanding lecture material, confidence in AI-based adaptive learning, and readiness to try this technology, a complex and informative picture is drawn. First, related with awareness of academic inequality among students, the majority of respondents showed concern and recognition of this problem. As many as 90% of respondents agreed or strongly agreed that academic inequality is a significant problem. This gives an indication that students have an awareness of the challenges faced by their peers and that this issue needs to receive further attention. Second, in terms of learning preferences, it was found that the majority of respondents, namely 90%, had a tendency or preference specific to the way they learn, with the majority choosing the agree option. This illustrates the need for diverse learning approaches and adjustments in the presentation of material to suit various learning styles among students.

Third, in the context of difficulty understanding lecture material, the results show that 50% of respondents agreed or strongly agreed that they faced difficulties in understanding material. This signals that existing learning approaches may require evaluation and improvement to provide better support to students who find it difficult. Fourth, regarding confidence in AI-based adaptive learning as a solution to overcome academic inequality, the majority of respondents (80%) expressed Some believe in the potential of this solution. Although there are still neutral respondents, these results show optimism regarding the possibility of technology to contribute to solving the problem of academic inequality.

Finally, regarding readiness to try AI-based adaptive learning if it is available in the learning environment, 75% of respondents stated they were willing. This reflects enthusiasm and positive acceptance of advanced technology in supporting the learning process. Although some respondents chose the neutral option, the willingness of the majority is an indication that students see added value in adopting these innovations. In conclusion, the results of the analysis highlight the importance of paying attention to the issue of academic inequality among students as well as the

need to adopt a more inclusive and diverse learning approach. Apart from that, the results also show the complexity of learning preferences, challenges in understanding lecture material, as well as the level of confidence and readiness of students towards implementing AI-based adaptive learning technology. These conclusions provide a strong basis for improving and developing learning strategies that can enhance the learning experience and address academic inequalities among students. Thus, efforts to integrate technology and innovation in education must take into account the variations in student needs and views in order to create an inclusive and effective learning environment.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

Author 4: Formal analysis; Methodology; Writing - original draft.

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