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Mitigating Cognitive Biases in Education: The Role of AI-Generated Quizzes in Enhancing Student Learning Outcomes

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ABSTRACT

The study of learning biases school students face is gaining more attention in education psychology. The present research explores how different cognitive biases influence how students perceive, process, and retain information. Various learning biases, such as confirmation bias, Dunning-Kruger effect, Halo effect, sunk cost fallacy, bandwagon effect, self-serving bias, fixed mindset, recency effect, anchoring bias, and others, are responsible for shaping students' educational experiences as they affect student motivation, engagement, and self-efficacy. AI-generated quizzes are a powerful tool that helps students overcome learning biases because such quizzes provide personalized, adaptive learning experiences that challenge existing misconceptions and promote more profound understanding. AI quiz ensures the learning process is customized to meet students' needs and knowledge gaps. AI quizzes ensure that every student is challenged appropriately by using adaptive algorithms that can adjust the difficulty level of questions per student's performance. These quizzes also provide immediate, comprehensive, and unbiased feedback, which helps students identify their areas of strength and areas where they need to improve. In conclusion, AI-generated quizzes pose a highly promising strategy in education. They mitigate cognitive biases by encouraging students to have a growth-oriented mindset and improve their learning experience. As educators leverage AI technology, educational excellence is seeing a new era where every student gets an equal opportunity to achieve academic success and unlock their full learning potential.

Background of the Research

In the field of Education psychology, the study of learning biases faced by school students is gaining more attention. The present research explores how different cognitive biases influence the ways in which students perceive, process, and retain information. It also explored hoe their academic performance and intellectual development is impacted in this regard. Various learning biases like confirmation bias, Dunning-Kruger effect, Halo effect, sunk cost fallacy, bandwagon effect, self-serving bias, fixed mindset, recency effect, anchoring bias, etc. are responsible for shaping the educational experiences of students as they affect student motivation, engagement, and self-efficacy (Isman, 2023; Hutt & Hieb, 2024; Lu et al., 2021). Such biases can hinder learning by reinforcing misconceptions, limiting critical thinking, and fostering a learning environment where feedback and criticism is accepted and appreciated.

To develop educational strategies that are highly effective, it is important to understand the nature and impact of such biases. According to many researchers, cognitive biases play a significant role in many different contexts like classroom interactions, assessment practices, and individual study habits (Hutt & Hieb, 2024). According to Zubkova (2023), the policymakers and educators can develop targeted approaches to avoid the negative effects of cognitive biases on students, by identifying the specific biases that generally affect school-aged students. They can raise awareness among the students about the existence and effects of these biases and can also implement instructional methods to promote critical thinking, reflection, and an openness to feedback and diverse perspectives (Schroeder et al., 2022).

All education systems are always striving to improve the learning outcomes for students, and addressing the issue of learning biases presents a great opportunity to create learning environments that are equitable as well as effective.

Justification of the Research

The reason for conducting research on the learning biases faced by school students is the need to improve educational outcomes by addressing the cognitive barriers that are responsible for hindering the academic performance and intellectual growth of students. Many learning biases like confirmation bias, self-serving bias, and fixed mindset can impact the perception of students negatively, discourage persistence in challenging subjects, and impact the understanding of academic content (Le Bihan, 2024). The impact of these biases is not limited to the students alone, as they also impact the broader education inequities. According to Wang and Cheng (2021), they may affect students that come from diverse backgrounds. Students have varying levels of prior knowledge; these biases may also have an impact in this regard. Researchers can study these biases in a systematic manner to get a clear understanding of their prevalence, manifestations, and impacts on the learning ability of students. Having a clear understanding is necessary for developing targeted interventions and strategies that promote accurate self-assessment, critical thinking, and resilience, when academic challenges are presented.

Addressing the learning biases by the means of research is a practical endeavour that can have many implications for the educational practices. By creating and using effective strategies and interventions to mitigate such biases, the learning environment can be made more inclusive and conducive to intellectual curiosity. For example, Ahmed et al. (2022) and Bianco (2021) agree that with a better understanding of how confirmation bias makes students ignore disconfirming evidence, the design curricula, and the teaching methods emphasising on evidence-based reasoning and diverse perspectives, can be informed. Le Bihan (2024) argues that getting insights into the fixed mindset of students can also help in introducing initiatives that allow students to have a growth mindset, and encourage them to think of challenges as opportunities for development, and not threats to their self-concept.

These interventions can potentially help in reducing the achievement gaps, increasing student engagement, and developing lifelong learning skills. AI-generated quizzes are a very powerful tool that help students in overcoming learning biases. According to Edeni et al. (2024), it is because such quizzes provide personalized, adaptive learning experience that challenge misconceptions that already exist, and promote deeper understanding. These quizzes can have questions that address common misconceptions, which will force students to not only confront, but also correct their biases.

AI is adaptive in nature; therefore, it can provide real-time feedback and adjust on the basis of student responses. This makes sure that the learning process is customised as per the student's needs and knowledge gaps (Zhai et al., 2021). Such a personalised feedback loop that highlights where a student's understanding is flawed, allows the student to identify and address his/her cognitive biases. It also offers students the correct guidance and encourages them to critically think about their answers and reasoning behind these answers. This makes more room for self-assessment and reflective learning.

Bias-mitigation strategies need to be scalable and accessible, and using AI based educational tools supports both- scalability and accessibility. Learning management systems can easily be integrated with AI-generated quizzes, which makes them more accessible for students regardless of their location or socio-economic status (Edeni et al., 2024). More students can benefit from such democratization of educational resources. Data generated and obtained from such quizzes can also provide valuable insights to the educators about the common learning biases and the specific areas where students tend to struggle (Tahiru, 2021). This allows the educators to make more informed decisions and provide highly targeted instructional support. Moreover, the AI technology can be used to creative a more responsive and dynamic learning environment which keeps adapting to student needs while promoting a deeper, unbiased understanding of academic content (Luckin & Holmes, 2016).

AI-generated quizzes are a powerful tool that also aid the study of cognitive biases in learning. They offer personalised and adaptive learning experiences that not only help students in recognising their cognitive biases, but

also overcome them. Integration of such technological solutions into the educational landscape can help in creating a learning environment that is highly inclusive, engaging, and effective. This will support students in many ways and help them in reaching their full learning potential.

Learning Biases and its Impact on Students

A student's motivation, engagement and self-efficacy are affected by learning biases like confirmation bias, Dunning-Kruger effect, Halo effect, sunk cost fallacy, bandwagon effect, self-serving bias, fixed mindset, recency effect, anchoring bias, etc. (Garrett et al., 2020; Owoc et al., 2019). These biases also impact the perception, process, and information retention for the students, shaping their academic experiences and outcomes. For example, Confirmation bias makes students believe in information that aligns with what they already believe, often ignoring contradictory evidence. The Dunning-Kruger effect makes students overconfident, when they have lower competence (He et al., 2023). The Halo effect makes educators overgeneralise a student's abilities based on his/her performance in a single area. The sunk cost fallacy can make students believe in ineffective study methods, due to previous investments of time or effort.

The Bandwagon effect makes students conform to peer norms, which potentially neglects their own learning needs. Self-serving bias makes students believe that successes are driven by personal ability and failures are driven by external factors, which impacts their self-improvement efforts (Knyazev & Oosterhuis, 2022). A fixed mindset negatively affects persistence in challenging subjects. The recency effect makes students neglect older yet equally important information and believe in the most recent information. Anchoring bias affects judgements by increasing the reliance on initial information. The hindsight bias makes students believe that they 'knew it all along' after an event (Yang et al., 2021). The illusion of transparency leads students to think that they are not as apparent to their teachers as their struggles are. The status quo bias makes students show resistance to new teaching methods. The framing effect is responsible for influencing the decisions based on how information is presented. It is necessary to address these biases in order to foster critical thinking and develop highly effective learning strategies. The following paragraphs explain a few of the above-mentioned biases in detail.

Confirmation Bias

Confirmation bias is the cognitive tendency to consume information in a way that confirms a person's pre-existing beliefs, and neglecting the consideration for alternative possibilities. This affects the way people process information presented to them, and makes them favour the information that aligns with their pre-existing beliefs. In this case, individuals also start undervaluing evidence that contradicts them (Ntoutsi et al., 2020). When it comes to a school's environment, confirmation bias can significantly negatively impact the learning potential of a student by narrowing their critical thinking skills and openness of their mindset.

A school level student can have confirmation bias in many ways, which affects his/her academic progress (Dee & Gershenson, 2017). For example, a student who believes that he is not good at mathematics will always focus on his mistakes and failures, without considering the instances where he has performed well. This leads to negative self-assessment, demotivating the students and discouraging them to seek academic help or put in extra effort.

Conversely, a student who believes that he excels in a particular subject might not consider any constructive criticism or feedback, if he has learned everything and there's nothing left for him to learn. This can hinder the student's academic growth (Grimes et al., 2017). Another example that can be considered in this case is a student who is conducting research with a preconceived conclusion. In this case, the student might selectively gather and interpret data that will support the preconceived conclusion, potentially neglecting contrary evidence that has the potential to offer a more balanced research foundation.

AI-generated quizzes can play an important role in helping students overcome confirmation bias as they offer personalized, adaptive learning experiences that have the potential to challenge the existing misconceptions in the minds of students (Khan, 2023). AI quizzed have balanced questions which are designed to confront the notions that students already have in mind. Such quizzes also force the students to consider alternative perspectives. They give a better understanding of the material by providing immediate, tailored feedback, where students get informative and detailed explanations and guidance.

In addition to that, AI systems can track response patterns, through which they identify areas where students exhibit bias. These systems adjust questions accordingly. Such an approach driven by adaptation makes sure that students are continuously engaging with the system and developing critical thinking skills (Vincent-Lancrin & Van der Vlies, 2020). AI allows widespread implementation as it is highly accessible and scalable. This can offer valuable insights to educators for providing targeted support and instructions. AI generated quizzes can enhance the overall academic performance and growth of students by fostering a more inclusive and effective learning environment.

Dunning-Kruger Effect

This effect is a cognitive bias wherein a person having less knowledge in a particular domain certainly overestimates his/her own competence. Dunning-Kruger effect makes the person have an inflated self-assessment, which also means that the person will lack awareness about his/her own limitations. This can have a significant impact on the learning potential, especially for school students (Yang et al., 2021). If a student starts believing that he understands a subject well than he does, he may start underestimating the requirement to study that particular subject further. He will also not seek further help or clarification in any aspect of that subject.

Moreover, having this level of overconfidence can negatively affect students' academic performance and decrease their ability to learn and understand complex concepts as they progress in their education (Wang et al., 2023a). For instance, a student who has performed well in a few maths problems might start thinking that he/she is a master of maths.

This may lead the student to stop preparing for more complex and challenging problems. Another example in which this bias could affect the learning ability of a student is when a student misinterprets a historical event, however, due to overconfidence, the student doesn't take teacher's corrections and feedback seriously, which perpetuates the student's misunderstanding (Pendy, 2021). In such cases, students also start neglecting the value of peer collaboration or stop seeking assistance from their teachers, which makes them miss out on valuable learning opportunities.

The Dunning-Kruger effect can be mitigated through AI-generated quizzes as such quizzes allow students to have an assessment of their own knowledge and skills. AI quizzes are adaptive in nature and they offer questions that increase in difficulty, considering the student's performance, which highlights the gaps that exist in the understanding of their own biases, that may have gone unrecognised otherwise (Bognár et al., 2021).

AI also provides prompt and detailed feedback which can highlight the areas of improvement for the student, counteract their overconfidence with evidence of how they have performed. In addition to that, these quizzes provide data that can help teachers in identifying the students exhibiting the Dunning-Kruger effect (Pendy, 2021). This allows the educators to use targeted strategies and interventions to help students get more accurate self-assessment. Such a tailored approach can help in getting a better understanding of students' abilities, creating a growth mindset, and better learning habits.

Halo Effect

In this type of a cognitive bias, one person's overall impression of another person clouds their judgement and forms an opinion about specific traits or abilities of the other person. When it comes to school students, the Halo effect can make teachers or peers generalise the abilities of a student by assessing a few aspects of the student's behaviour or

performance, which can have a huge impact on the learning potential (Sanchez et al., 2020). For instance, a student excelling in one subject like English, is generally perceived to be excelling in all other subjects, even if their actual performance being average in other subjects. This may set unrealistic expectations and differential treatment in the case of that student, which might affect the self-esteem or motivation of the student, especially in the subjects where he/she doesn't perform well (Areed et al., 2021).

Another example of the Halo effect in education can be a situation where a teacher assumes that a student who excels in sports to be academically good as well. Teachers may also perceive that a student who is shy or introverted is less capable or intelligent, regardless of the student's actual academic abilities (Wang et al., 2023b). These biased perceptions limit growth opportunities for students as they may get the encouragement or support from their teachers in aspects where they might need it.

Halo effect can be mitigated by AI-generated quizzes as these quizzes give an unbiased assessment the student's overall knowledge and capabilities in different subjects. Performance evaluation in such quizzes is done based on an objective criterion, which is independent of any preconceived notions or biases. AI quizzes create an accurate and comprehensive student profile as they offer personalised feedback and identify the overall strengths and weaknesses of the students (Alam, 2023). Such an approach helps educators in learning more about a student's pain points to address where they need support. It also helps students in getting a more equitable treatment which is based on the merits of the students, instead of their superficial impressions. AI quizzes can encourage fairness in assessments and help in making the learning environment more inclusive. They help in giving students a fair opportunity to reach their full potential, despite their superficial perceptions.

The Recency Effect

In this type of a cognitive bias, people tend to consider recent information to be more important than the previously presented information. Such a bias affects the learning potential of students as students tend to focus on the recent topics covered in class, which may make them neglect topics that they have previously learned (Fitria, 2021). This makes students struggle with cumulative exams and assignments that cannot be completed without having a comprehensive knowledge in a subject. The recency effect can be seen in real life scenarios where a student learns a new concept in maths and forgets the foundational principles which were learned earlier (Eglington & Pavlik Jr, 2023). This can make it difficult for the student to solve more complex problems where old as well as new concepts are applied. Another example is when a student only learns the recent chapters for a history exam, overlooking the important events that may have been mentioned earlier in the course. This can create a gap in knowledge and lead to incomplete understanding of the course material, negatively affecting the overall academic performance of the students.

Recency effect can be identifying and addressed through AI-generated quizzes as they provide a balanced and comprehensive review of everything that has been covered in the course curriculum. Such quizzes can include questions from different topics of the syllabus, making sure that students come across previous topics and revisit those concepts. AI quizzes encourage overall engagement of the students by asking questions that are a mix of recent and older topics, instead of just focussing on the new concepts (Srinivasan, a2022).

Adaptive algorithms used in AI quizzes are also effective in identifying areas where a student may have forgotten earlier content and tailor questions to address these gaps, promoting a more thorough and integrated understanding. Furthermore, according to Liang et al. (2023), AI-generated quizzes offer immediate feedback, which helps students identify and address gaps that exist in their comprehension of the subject. Bringing up previously learned matter to revisit all the concepts of a subject helps in developing a strong cognitive connection to get a deeper understanding of the subject (Mousavi et al., 2020). AI quizzes counteract the recency effect to make sure that students focus on all aspects of a subject and maintain a balance in their learning, which in turn, improves the overall academic performance of the students and help them in long-term retention of the knowledge.

Anchoring Bias

It is a cognitive bias where people tend to make decisions or judgements based on the very first piece of information they get (the "anchor"). The thoughts and actions of individuals are highly influenced by this piece of information which skews their decisions. School students' learning potential is affected by anchoring bias as it makes them stick to the first impressions or early experiences, which are not always accurate and do not cover all aspects of a topic (Rhue, 2019). For instance, when a student gets graded on the first test of the science subject, and the grade is low, he/she might make a perception of having low scientific abilities, due to the poor initial performance.

Even when the student improves subsequently in other science tests, his/her perception might persist, toning down the confidence and motivation to learn more about the subject. A similar situation arises when a teacher gives a strong positive remark about the initial performance of a student in a particular aspect (Santhanam et al., 2020). The student then believes more in his/her competence and might even overestimate his/her abilities. The student may also neglect the necessary effort required to master that aspect, directly resulting in potential underperformance in the future.

According to Richie et al. (2018), students can overcome anchoring bias through AI-generated quizzes as these quizzes assess their knowledge continuously through varied and objective assessments. AI quizzes have questions that force students to think beyond their first impressions and engage with the subject matter on various levels. When students are regularly exposed to new and challenging questions about a subject, they might stop relying on initial impressions and try to get a more balanced and deeper understanding of study material. AI quizzes give immediate feedback that allows students to recalibrate their understanding of the subject matter and work on their self-assessment in real time.

Hooda et al. (2022) further points out that the AI systems can also highlight the progress of a student through the improved performance that goes from struggling to being proficient in a subject through immediate feedback and repeated exposure. This helps in mitigating the anchoring bias. Conversely, when a student uses the initial good performance in a subject to assess his/her capabilities, AI quizzes can bring up questions which are more challenging. This will help the students realise that they need a deeper understanding of the subject in order to keep up with the good performance, preventing overestimation of their abilities. This is how quizzes generated by AI promote a more accurate self-perception among school students.

AI quizzes consistently adjust and adapt to the performance of students and bring up various challenges to mitigate the effects of anchoring bias. It offers a more realistic learning approach, which is also comprehensive. As a result, the academic performance is improved and students become more resilient in solving complex problems and adaptable to new skills in the ever-evolving landscape of education.

Self-Serving Bias

Self-serving bias is a cognitive bias where individuals start believing that all their successes are driven by internal factors like their own efforts and intelligence, while all their failures are blamed on external factors like task difficulty or luck. This type of cognitive bias affects the learning potential of school students by giving them a wrong self-perception. It can also hinder their ability to identify areas of improvement and make efforts to improve their overall performance (Schiff, 2021).

When students take credit for their successes, but not for their failures, they miss out on many growth opportunities and the aspect of accurate self-reflection (Tang, 2024). For instance, a student gets a good result and considers this success to be driven by his natural ability, and when the results show poor performance, he blames it on external factors like test difficulty or inadequate teaching. Such a perception is formed by self-serving bias, and it leads to overconfidence and a fixed mindset, which makes the students believe that their abilities cannot be changed or improved.

With this thought in mind, they might also not put sufficient efforts to improve in subjects which are challenging for them because they believe that are facing difficulties due to factors that are not in their control. In a similar manner, when a student is graded low on an essay, they might blame it on the unfairness of the teacher, instead thinking about the potential weakness in their writing. They are become reluctant to getting feedback and putting in the effort for improvement.

Self-serving bias can be mitigated in school students through AI-generated quizzes as it provides immediate and consistent feedback which gives students a clearer picture of their abilities. AI quizzes are more efficient in tracking a student's performance over time and they offer a clear picture of the strengths as well as weaknesses of the students' abilities (Hahn et al., 2021). Students tend to take accountability for their performance when they are offered immediate feedback that highlights the areas of good as well as poor performance.

Chen et al. (2020) further argues that this also helps students in understanding that they can improve in their weak areas by putting in the right amount of efforts, and weaknesses are not driven by factors that are beyond their control. In addition to that, AI quizzes can have reflective questions that encourage students to emphasise more on the reasoning of their answers (Ehrlinger et al., 2016). It makes them more introspective and helps them recognise their contributions that have led to their success as well as failure. AI generated quizzes foster a growth mindset where students start to believe that their abilities can be improved through continuous learning and effort. This promotes resilience and adaptability. Self-serving bias can limit the potential of a student by making them neglect constructive self-assessment (Cope et al., 2021). However, AI-generated quizzes help them develop a growth-oriented mindset and encourages them to improve their academic performance.

Bandwagon Effect

This type of cognitive bias occurs when a person gets influenced by other people to adopt certain behaviours, beliefs, or attitudes. School students get influenced by the bandwagon effect when they start shaping their academic choices, habits and subject perceptions as per the opinions of their peers, instead of using personal evaluation or critical thinking (Knyazev & Oosterhuis, 2022). Students get influenced by the bandwagon effect when they disregard their own opinions and learning interests, and shape their choices as per the popular opinions of their peers and current trends. For example, in a classroom setting, if all some students show disinterest in a subject, and others follow the same thought without considering the value that subject holds for them, they are succumbed to the bandwagon effect. This can make students disengage with that subject, without even considering an alternative perspective (Mansharamani, 2020). This effect also creates an environment where social dynamics influence the academic achievements as well as choices of the students, instead of their own individual merits or academic interests.

Quizzes generated through AI provide a valuable tool that helps students in avoiding the bandwagon effect by offering them a more personalised and objective assessment of their knowledge, interests and skills. This challenges students to explore different perspectives through a variety of questions, fostering critical thinking skills and self-evaluation (Khosravi et al., 2022). AI quizzes help students in getting a deeper understanding of the subjects through different questions and tasks that need to be done individually, which encourages personal evaluation and intellectual exploration. It helps students in using their own brain rather than blindly following the crowd.

AI-generated quizzes can incorporate algorithms that support adaptive learning, which adjusts the difficulty of quiz questions according to the student responses (Ouyang et al., 2022). This makes sure that every student gets a personalised learning experience. According to Seldon et al. (2020), It helps in mitigating the effect of peer influence or conformity by giving more focus to the individual's own progress and development. AI's immediate feedback also offers the right insights into the strong and weak suits of the students, encouraging them to make informed academic decisions as per their personal evaluations.

Therefore, AI-generated quizzes can help in mitigating the bandwagon effect by offering personalised assessments and adaptive learning techniques, in order to help students develop independent thought and critical thinking and embrace their own growth rather than embracing peer influence.

Fixed Mindset Bias

This type of bias is highlighted when individuals believe that their abilities and intelligence cannot be changed, and are static in nature. Such a belief can hinder the learning potential of school students as they might become reluctant to taking up on challenges and risks (Schwartz et al., 2022). Students who have a fixed mindset tend to avoid difficult tasks and subjects because they think of their mistakes and challenges as limitations, and not growth opportunities. For instance, a student who has a fixed mindset may not enrol in any advanced course because they start believing that their abilities are limited to the basic concepts of a subject, which cannot be improved by trying out advanced courses.

Similarly, Hutt and Hieb (2024) point out that when students are given an assignment that is more challenging than usual, they easily get discouraged and may not put the effort to complete the assignment successfully. Such a mindset hinders learning as it makes achievements stagnant and makes students mis out on growth opportunities. AI-quizzes allow students to overcome their fixed mindset bias by encouraging them to take a growth-oriented learning perspective. Such quizzes keep adding challenging questions by gradually increasing the difficulty level, in order to offer improvement opportunities.

According to Sanchez et al. (2020), the AI-generated quizzes can present tasks to the students that require subsequent amount of effort, in order to help them recognise the abilities that can be developed through practice, rather than thinking that their abilities are unchangeable. The immediate feedback provided by AI-quizzes highlights areas of strength as well as areas of improvement that encourages students to think of their mistakes as learning opportunities, and not limitations, which leads them towards academic success.

A fixed mindset bias can make students can add fear of failure in the minds of students, which can be eliminated by AI-generated quizzes as they offer personalized challenges, incremental progress tracking, and constructive feedback (Mansharamani, 2020). This puts larger emphasis on the importance of putting and effort to achieve growth in the academic suits. AI-quizzes help students in learning with resilience and confidence, which leaves a positive impact on their learning abilities.

Sunk Cost Fallacy

Sunk cost fallacy is a cognitive bias wherein individuals tend to keep investing their time and effort into something because they have been investing in it since a long time, regardless of its decreasing returns or lack of benefits in the future. School students are affected by this bias as it negatively impacts their learning potential, causing them to keep investing their efforts in ineffective study methods or struggling subjects, only because they have been studying them for a long time (Sirois, 2019).

Sunk cost fallacy affects students in a way that makes them feel compelled to continue pursuing a certain approach or subject, even after they realise that they will not get the desired learning outcomes from it (Sirois, 2019). For example, a student who has spent a good time memorising facts for a history exam, may always use this approach to learn for the exam, even if it doesn't help him/her get a deeper understanding of the historical context. Another example is when a student studying an advanced mathematics course may keep on struggling with the complex problems, instead of using a different approach, because they have already invested a lot of time and effort into mastering the basics, that too, through a certain approach. In such cases, the sunk cost fallacy bias can waste time and make students miss out on learning opportunities wherein they can explore more effective approaches to learning or try out different subjects.

AI-quizzes can mitigate the effect of sunk cost fallacy by providing immediate feedback to the students about their learning progress. Such quizzes can easily evaluate a student's understanding of a particular subject or concept in real-time, and provide feedback highlighting areas where exploring alternative approaches is necessary. According to Sirois (2019), this helps students in making informed decisions about putting their time and effort in which areas

and approaches. AI's adaptive nature helps in adjusting the difficulty of AI quiz questions according to the student performance, which challenges students every step of the way, instead of letting them consistently struggle in one aspect.

According to Zaman (2024), the AI-generated quizzes can also encourage students in considering why their current approach is not giving them the desired outcome, in order to help them make the necessary adjustments. AI-generated quizzes ultimately help students in identifying when they need to persist, and when they need to pivot, through objective feedback, contributing to a better learning experience.

Conclusion

AI-generated quizzes can be an effective approach for mitigating cognitive biases in education, and they can significantly improve the learning outcomes for the students. Cognitive biases like the confirmation bias and the Dunning-Kruger effect have a huge impact on students' academic experiences as they influence the perceptions, decision-making, and overall learning strategies. Confirmation bias makes students hinders the ability of students to evaluate new ideas and information as it makes them interpret information in a way that aligns with their pre-existing beliefs. Unlike the confirmation bias, the Dunning-Kruger effect makes students overestimate their competence in a few subjects, which can cause them to resist constructive feedback or make additional efforts to get a deeper understanding of that subject.

These challenges are addressed by AI-generated quizzes as these quizzes offer personalised assessments that can easily adapt to every student's unique learning needs and capabilities. AI-quizzes ensure that every student is challenged appropriately by using adaptive algorithms that can adjust the difficulty level of questions as per student performance. These quizzes also provide immediate, comprehensive and unbiased feedback which helps students in identifying their areas of strength as well as areas where they need to improve. These AI quizzes promote a growth-oriented mindset among school students, making them believe that their abilities can be developed and improved through continuous efforts and perseverance, instead of them being fixed traits.

In addition to that, AI-quizzes can also be helpful in mitigating other cognitive biases like the Halo effect, wherein students tend to get influenced by initial impressions or external factors which are not related to their own abilities. AI-generated assessments focus more on academic merit and demonstrated knowledge to provide a fair evaluation framework that encouraged students to improve their learning outcomes. It also fosters a learning environment where every student's progress and abilities are consistently measured against a transparent criteria, instead of using subjective judgments which could also be an outcome of external biases. Integrating AI technology into education strategies can also help educators in developing targeted approaches derived through data that was obtained from AI-quizzes. Educators and teachers can identify patterns in the performance of students and customise their instructional approaches to fill the learning gaps and make complex concepts easy to understand for the students. Such an adaptive method of teaching can enhance the overall effectiveness of interventions which are specifically designed to help students improve their learning outcomes, within the classroom.

AI technology is ever-evolving, and it has a significant positive impact on education. Educators can leverage this technology by expanding the application of AI-quizzes across different subjects and levels of education. This will help in fostering better engagement, critical thinking, and creativity among students. All this suggests that AI can play a significant role in mitigating cognitive biases and can transform the education sector and its equity in the 21st century. In conclusion, AI-generated quizzes pose a highly promising strategy in education by mitigating the cognitive biases by encouraging students to have a growth-oriented mindset, and improve their learning experience. As AI technology is being leveraged by educators, educational excellence is seeing a new era where every student gets an equal opportunity to achieve academic success and unlock their full learning potential.

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References

Ahmed, S., Khalil, M. I., Chowdhury, B., Haque, R., bin S Senathirajah, A. R., & bin Omar Din, F. M. (2022). Motivators and barriers of artificial intelligent (AI) based teaching. *Eurasian Journal of Educational Research*, *100*(100), 74-89.

Alam, A. (2023). Harnessing the Power of AI to Create Intelligent Tutoring Systems for Enhanced Classroom Experience and Improved Learning Outcomes. In *Intelligent Communication Technologies and Virtual Mobile Networks* (pp. 571-591). Singapore: Springer Nature Singapore.

Areed, M. F., Amasha, M. A., Abougalala, R. A., Alkhalaf, S., & Khairy, D. (2021). Developing gamification e-quizzes based on an android app: the impact of asynchronous form. *Education and Information Technologies*, *26*, 4857-4878.

Bianco, M. (2021). *Overcoming the social barriers of AI adoption* (Doctoral dissertation, Master's Thesis, Eindhoven University of Technology] https://research. tue. nl/en/studentTheses/overcoming-the-social-barriers-of-ai-adoption).

Bognár, L., Fauszt, T., & Váraljai, M. (2021). The impact of online quizzes on student success. *International Journal of Emerging Technologies in Learning (iJET)*, *16*(11), 225-244.

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *Ieee Access*, *8*, 75264-75278.

Cope, B., Kalantzis, M., & Searsmith, D. (2021). Artificial intelligence for education: Knowledge and its assessment in AI-enabled learning ecologies. *Educational philosophy and theory*, *53*(12), 1229-1245.

Dee, T. S., & Gershenson, S. (2017). Unconscious bias in the classroom: Evidence and opportunities. Mountain View, CA: Google Inc.

Edeni, C. A., Adeleye, O. O., & Adeniyi, I. S. (2024). The role of AI-enhanced tools in overcoming socioeconomic barriers in education: A conceptual analysis. *World Journal of Advanced Research and Reviews*, *21*(3), 944-951.

Eglington, L. G., & Pavlik Jr, P. I. (2023). How to optimize student learning using student models that adapt rapidly to individual differences. *International Journal of Artificial Intelligence in Education*, *33*(3), 497-518.

Ehrlinger, J., Mitchum, A. L., & Dweck, C. S. (2016). Understanding overconfidence: Theories of intelligence, preferential attention, and distorted self-assessment. *Journal of Experimental Social Psychology*, *63*, 94-100.

Fesakis, G., & Prantsoudi, S. (2021, November). Raising artificial intelligence bias awareness in secondary education: the design of an educational intervention. In *ECIAIR 2021 3rd European Conference on the Impact of Artificial Intelligence and Robotics* (p. 35). Academic Conferences and publishing limited.

Fitria, T. N. (2021, December). Artificial intelligence (AI) in education: Using AI tools for teaching and learning process. In *Prosiding Seminar Nasional & Call for Paper STIE AAS* (Vol. 4, No. 1, pp. 134-147).

Garrett, N., Beard, N., & Fiesler, C. (2020, February). More than" If Time Allows" the role of ethics in AI education. In *Proceedings of the AAAI/ACM Conference on AI, Ethics, and Society* (pp. 272-278).

Grimes, A., Medway, D., Foos, A., & Goatman, A. (2017). Impact bias in student evaluations of higher education. *Studies in higher education*, *42*(6), 945-962.

Hahn, M. G., Navarro, S. M. B., Valentín, L. D. L. F., & Burgos, D. (2021). A systematic review of the effects of automatic scoring and automatic feedback in educational settings. *IEEE Access*, *9*, 108190-108198.

He, G., Kuiper, L., & Gadiraju, U. (2023, April). Knowing about knowing: An illusion of human competence can hinder appropriate reliance on AI systems. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (pp. 1-18).

Hooda, M., Rana, C., Dahiya, O., Rizwan, A., & Hossain, M. S. (2022). Artificial intelligence for assessment and feedback to enhance student success in higher education. *Mathematical Problems in Engineering*, *2022*(1), 5215722.

Hutt, S., & Hieb, G. (2024). Scaling Up Mastery Learning with Generative AI: Exploring How Generative AI Can Assist in the Generation and Evaluation of Mastery Quiz Questions. In *Proceedings of the Eleventh ACM Conference on Learning@ Scale* (pp. 310-314).

Isman, S. M. (2023). AI-Powered quizzes in online learning: Exploring opportunities and challenges. In *International Conference on Teaching and Learning* (Vol. 1, pp. 386-396).

Khan, S. (2023). The Ethical Imperative: Addressing Bias and Discrimination in AI-Driven Education. *Social Sciences Spectrum*, *2*(1), 89-96.

Khosravi, H., Shum, S. B., Chen, G., Conati, C., Tsai, Y. S., Kay, J., ... & Gašević, D. (2022). Explainable artificial intelligence in education. *Computers and Education: Artificial Intelligence*, *3*, 100074.

Knyazev, N., & Oosterhuis, H. (2022, August). The bandwagon effect: not just another bias. In *Proceedings of the 2022 ACM SIGIR International Conference on Theory of Information Retrieval* (pp. 243-253).

Knyazev, N., & Oosterhuis, H. (2022, August). The bandwagon effect: not just another bias. In *Proceedings of the 2022 ACM SIGIR International Conference on Theory of Information Retrieval* (pp. 243-253).

Le Bihan, E. (2024). Navigating artificial intelligence in education: first-and second-order barriers to the implementation of AI in Finnish classrooms.

Lu, O. H., Huang, A. Y., Tsai, D. C., & Yang, S. J. (2021). Expert-authored and machine-generated short-answer questions for assessing students learning performance. *Educational Technology & Society*, *24*(3), 159-173.

Luckin, R., & Holmes, W. (2016). Intelligence unleashed: An argument for AI in education. *UCL Knowledge Lab*: London, UK.

Mansharamani, V. (2020). *Think for yourself: Restoring common sense in an age of experts and artificial intelligence*. Harvard Business Press.

Mousavi, R., Raghu, T. S., & Frey, K. (2020). Harnessing artificial intelligence to improve the quality of answers in online question-answering health forums. *Journal of Management Information Systems*, *37*(4), 1073-1098.

Ntoutsi, E., Fafalios, P., Gadiraju, U., Iosifidis, V., Nejdl, W., Vidal, M. E., ... & Staab, S. (2020). Bias in data-driven artificial intelligence systems—An introductory survey. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, *10*(3), e1356.

Ouyang, F., Zheng, L., & Jiao, P. (2022). Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020. *Education and Information Technologies*, *27*(6), 7893-7925.

Owoc, M. L., Sawicka, A., & Weichbroth, P. (2019, August). Artificial intelligence technologies in education: benefits, challenges and strategies of implementation. In *IFIP International Workshop on Artificial Intelligence for Knowledge Management* (pp. 37-58). Cham: Springer International Publishing.

Pendy, B. (2021). Artificial intelligence: The future of education. *Jurnal Indonesia Sosial Sains*, *2*(11).

Rhue, L. (2019). Beauties in the AI of the beholder: how AI anchors subjective and objective predictions. *ICIS 2019 Proceedings*. 15.

Richie, M., & Josephson, S. A. (2018). Quantifying heuristic bias: anchoring, availability, and representativeness. *Teaching and learning in Medicine*, *30*(1), 67-75.

Sanchez, D. R., Langer, M., & Kaur, R. (2020). Gamification in the classroom: Examining the impact of gamified quizzes on student learning. *Computers & Education*, *144*, 103666.

Santhanam, S., Karduni, A., & Shaikh, S. (2020, April). Studying the effects of cognitive biases in evaluation of conversational agents. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (pp. 1-13).

Schiff, D. (2021). Out of the laboratory and into the classroom: the future of artificial intelligence in education. *AI & society*, *36*(1), 331-348.

Schroeder, K. T., Hubertz, M., Van Campenhout, R., & Johnson, B. G. (2022). Teaching and learning with AI-Generated Courseware: Lessons from the Classroom. *Online Learning*, *26*(3), 73-87.

Seldon, A., Abidoye, O., & Metcalf, T. (2020). *The Fourth Education Revolution Reconsidered: Will Artificial Intelligence Enrich or Diminish Humanity?* Legend Press Ltd.

Sirois, L. P. (2019). The psychology of sunk cost: A classroom experiment. *The Journal of Economic Education*, *50*(4), 398-409. *Ergo: An Open Access Journal of Philosophy*, 6:1153-1190.

Srinivasan, V. (2022). AI & learning: A preferred future. *Computers and Education: Artificial Intelligence*, *3*, 100062.

Tahiru, F. (2021). AI in education: A systematic literature review. *Journal of Cases on Information Technology (JCIT)*, *23*(1), 1-20.

Tang, K. H. D. (2024). Implications of Artificial Intelligence for Teaching and Learning. *Acta Pedagogia Asiana*, *3*(2), 65-79.

Tsai, D. C., Huang, A. Y., Lu, O. H., & Yang, S. J. (2021, July). Automatic question generation for repeated testing to improve student learning outcome. In *2021 International Conference on Advanced Learning Technologies (ICALT)* (pp. 339-341). IEEE.

Vincent-Lancrin, S., & Van der Vlies, R. (2020). Trustworthy artificial intelligence (AI) in education: Promises and challenges. *OECD Education Working Papers*, No. 218, OECD Publishing, Paris.

Wang, T., & Cheng, E. C. K. (2021). An investigation of barriers to Hong Kong K-12 schools incorporating Artificial Intelligence in education. *Computers and Education: Artificial Intelligence*, *2*, 100031.

Wang, T., Lund, B. D., Marengo, A., Pagano, A., Mannuru, N. R., Teel, Z. A., & Pange, J. (2023a). Exploring the potential impact of artificial intelligence (AI) on international students in higher education: Generative AI, chatbots, analytics, and international student success. *Applied Sciences*, *13*(11), 6716.

Wang, X., Wrede, S., van Rijn, L., & Wöhrle, J. (2023b). AI-Based Quiz System For Personalised Learning. In *ICERI2023 Proceedings* (pp. 5025-5034). IATED.

Yang, S. J., Ogata, H., Matsui, T., & Chen, N. S. (2021). Human-centered artificial intelligence in education: Seeing the invisible through the visible. *Computers and Education: Artificial Intelligence*, *2*, 100008.

Zaman, B. U. I. (2024). Transforming education through AI benefits risks and ethical considerations. *Preprints*, 2024070859.

Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., ... & Li, Y. (2021). A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. *Complexity*, *2021*(1), 8812542.

Zubková, N. V. K. (2023). The Potential of Ai Tools In Formal Education. *Marketing Identity*, 427.