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TEACHER PERSPECTIVES ON AI-DRIVEN GAMIFICATION: IMPACT ON STUDENT MOTIVATION, ENGAGEMENT, AND LEARNING OUTCOMES

Abstract. This study delves into the insights and experiences of teachers regarding the influence of AI-driven gamification on student motivation, engagement, and learning outcomes. Through qualitative research methods, teacher perspectives are explored to unravel the multifaceted aspects of AI-enhanced gamification within educational settings. The study identifies several significant themes, including positive perceptions of AI-driven gamification, challenges in implementation, elevated motivation and engagement, enhanced learning experiences, improved learning outcomes, and the complexities of assessing long-term effects.

The findings underscore the transformative potential of AI-driven gamification, as educators highlight its ability to create democratic, effective, and transformative learning environments. Nevertheless, the study also uncovers challenges related to professional development, technical glitches, and curriculum alignment in the implementation of this innovative approach. Moreover, the study reveals a resounding consensus among teachers regarding the positive impact of AI-driven gamification on student motivation, participation, and learning experiences.

Teachers emphasize how AI-driven gamification can turn ordinary learning into enjoyable and meaningful journeys, offering students autonomy and real-time feedback. Furthermore, teachers believe that AI-driven gamification contributes to improved learning outcomes, fostering a deeper understanding of subject matter, knowledge retention, and enhanced problem-solving skills. Despite these short-term gains, teachers acknowledge the need for longitudinal studies to comprehensively assess the long-term effects of AI-driven gamification on learning outcomes.

Keywords: AI-driven gamification; teacher perspectives; student motivation; student engagement; learning outcomes.

1. INTRODUCTION

The problem statement. The research problem addressed in this study is to investigate the impact of AI-driven gamification on student motivation, engagement, and learning outcomes in primary schools in Arar, Saudi Arabia. While there is existing literature highlighting the potential benefits of AI-driven gamification in education [1], [2], there is a distinct lack of empirical research within the Saudi Arabian educational context. This study aims to bridge this gap by exploring teacher perspectives on AI-driven gamification, focusing on its implementation, its influence on student motivation and engagement, and its outcomes on student learning.

Furthermore, this research seeks to identify any challenges or limitations associated with the integration of AI-driven gamification into the educational setting. Technical glitches, as highlighted in previous studies Rong et al[3], have the potential to disrupt the learning process, and understanding how these challenges manifest in the Saudi Arabian context is essential. Moreover, concerns about curriculum integration, as voiced by teachers [4], are relevant as they may impact the alignment of AI-driven gamification with educational objectives.

This research problem is significant as it addresses a growing interest in harnessing technology and gamification strategies to enhance education, which is a global trend [5]. Understanding the experiences and perceptions of teachers in Saudi Arabia, a culturally diverse and dynamic educational context, can provide valuable insights into the feasibility and effectiveness of AI-driven gamification. Moreover, this study contributes to the broader field

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of educational technology and pedagogy [6] by shedding light on the potential benefits and challenges associated with AI-driven gamification, ultimately serving the interests of educators, policymakers, and researchers striving to improve teaching and learning outcomes.

Analysis of recent studies and publications. Gamification has been employed in Massive Open Online Courses and classroom experiments to assess its effectiveness in shaping student motivation, attitudes toward learning, peer learning, social interdependence, achievement, and emotions [7]. The fusion of gamification with cutting-edge technologies like artificial intelligence and virtual reality holds the promise of making theoretical teaching more engaging and exciting for both students and educators. AI-driven gamification has the potential to revolutionize educational approaches in the classroom, with student engagement identified as a pivotal factor in enhancing motivation and supporting learning [8] .

Gamification, characterized by the incorporation of game elements into the learning process, taps into the motivational power of these elements within an educational context. These elements can include points, badges, leaderboards, and leveling up—features commonly encountered in games. AI-driven gamification surpasses traditional methods by leveraging artificial intelligence technologies to enhance the effectiveness of gamified learning experiences.

Artificial intelligence's role in gamification enables personalized and adaptive learning experiences. Educators can use AI-driven gamification to customize content and challenges according to each student's individual needs, preferences, and learning styles. For instance, AI algorithms can assess a student's performance and offer personalized feedback and recommendations for improvement. Additionally, AI can analyze student engagement and progress data to identify areas requiring additional support [6]. Moreover, AI-driven gamification fosters a collaborative and interactive learning environment. It facilitates group activities and offers real-time feedback, encouraging teamwork and interaction among students [5]. Extensive research suggests that the integration of AI-driven gamification in classrooms positively influences student motivation, engagement, and learning outcomes, motivating active participation in the learning process [9] .

Plass et al. and Zhyhadlo [10], [11]categorize gamification as triggering four types of engagement: cognitive, affective, behavioral, and sociocultural, creating a more comprehensive and immersive learning experience. Furthermore, AI-driven gamification enhances learning outcomes. Numerous studies have reported enhanced academic achievement and knowledge retention among students who engage in AI-driven gamified learning activities. For instance, Cortizas et al. [12] found that students participating in AI-driven gamified learning activities scored higher on assessments and demonstrated a deeper understanding of the material compared to those who did not partake in gamified activities. Additionally, AI-driven gamification can address individual differences among students by personalizing the learning experience based on their unique strengths, weaknesses, and learning preferences. It provides immediate feedback, allowing students to monitor their progress and make real-time adjustments. This incorporation of AI-driven gamification also benefits educators, enabling them to analyze student data and gain insights into their performance while enhancing the social aspect of learning by promoting collaboration and peer learning [13] .

Despite the potential benefits, it is crucial to acknowledge the challenges and considerations associated with AI-driven gamification in education. The motivational power of gamification, particularly in an educational context, is well-documented and can enhance student engagement and motivation to learn. Gamification empowers students by providing a sense of competition and rewards, along with autonomy and control over their learning journey. Students can set goals, track their progress, and earn rewards or points for their achievements. This motivational aspect of gamification fosters increased engagement and motivation for learning within the classroom. Moreover, previous studies have shown that gamification leads

to increased conceptual knowledge when students engage in academic or education-related games. This method has been associated with several benefits and is widely adopted in many universities, enhancing learning efficiency and student engagement [14] .

The introduction of AI-driven gamification in education has heightened these benefits, particularly in terms of increasing student motivation. AI-driven gamification uses artificial intelligence algorithms to provide personalized learning experiences. These algorithms evaluate student performance, preferences, and learning styles, tailoring game-based activities and challenges to individual needs. This personalization significantly enhances student motivation by offering a relevant and individualized learning experience. Additionally, AI-driven gamification fosters student engagement by creating dynamic and adaptive learning experiences tailored to each student's unique strengths and areas for improvement. This personalized approach sparks student interest and maintains engagement throughout the learning process. Beyond motivation and engagement, AI-driven gamification has also been found to improve learning outcomes. Research by Lei et al. [15] demonstrates that students engaging in AI-driven gamified learning environments exhibit higher levels of knowledge retention and improved learning outcomes compared to traditional instructional methods. Furthermore, these techniques increase achievement motivation and enhance material absorption in students [16] .

While research has provided empirical evidence of gamification's positive impact on user engagement and achievement [2], the integration of AI techniques appears poised to enhance these outcomes even further. AI's capacity to personalize the educational experience and adapt to individual learning styles aligns with the perspectives of Roll and Wylie[17] , emphasizing its potential to revolutionize education.

Numerous studies have explored AI-driven gamification in education and its effects on teaching and learning. Research by Dichev & Dicheva [18] demonstrates that AI-powered gamification can enhance students' problem-solving abilities, as well as promote higher student motivation and engagement. Gamified activities enable learners to tackle complex challenges, fostering critical thinking and the development of lifelong learning skills. Moreover, Aldemir et al. [19]emphasize the motivational aspects of gamified learning, particularly when integrated with AI-driven techniques and robotic instruction. They underscore how elements like competition, challenge, socialization, and imagination can enhance learners' interest and active involvement.

However, implementing such technology is a complex process requiring careful consideration. Teachers, as key players in its successful integration, hold invaluable perspectives. While research often extols the potential benefits of AI-driven gamified learning [20], it rarely explores teachers' views on the matter. Teachers typically approach this integration with cautious optimism, acknowledging the potential benefits while emphasizing the need for further empirical evidence [21].

In light of this, this study aims to comprehensively examine teachers' perspectives regarding the integration of AI-driven gamification in the classroom and its impact on student outcomes. It seeks to answer the following questions:

- How do teachers perceive AI-driven gamification as an instructional strategy, and what are their experiences with its implementation in the classroom?
- How do teachers believe AI-driven gamification influences student motivation and engagement?
- What are the perceived effects of AI-driven gamification on students' learning outcomes and knowledge retention, as reported by teachers?

2. RESEARCH METHODS

2.1. Research Design

This study employs a phenomenological research design to delve into the lived experiences of teachers implementing AI-driven gamification in education in Saudi Arabia's primary schools. The phenomenological approach allows acquiring a comprehensive, in-depth understanding of the participants' perspectives – crucial for exploring both the opportunities and challenges that arose when implementing AI-driven gamification in classrooms [22].

2.2. Participants

The study was targets 15 teachers working within primary schools in Arar, Saudi Arabia. Teachers were purposefully selected based on their implementation of gamification in the classroom, assuring a rich and varied pool of experiences.

2.3. Data Collection

Participants were partake in semi-structured interviews, which were recorded (with their consent) for accuracy. The informed consent process involves explaining research aims, the participant's role, and the voluntary nature of participation. Key interview themes were around teachers' experiences, views on gamification benefits, challenges, and suggestions for practical gamification applications.

2.4. Reliability

Consistent Data Collection: To ensure consistency in data collection, semi-structured interviews were conducted using predefined questions and prompts. This approach helped in maintaining uniformity across interviews.

Transcription Accuracy: The interviews were transcribed verbatim, preserving the accuracy and authenticity of the participants' responses. This step is crucial in minimizing potential errors or misinterpretations.

Thematic Analysis: Thematic analysis, a systematic and structured approach, was employed for data analysis. This method involves a well-defined process of data coding and theme identification, contributing to the reliability of the analysis.

Peer Review: To enhance the reliability of the findings, a peer review process was conducted. Another researcher or peer reviewed a subset of the data, ensuring that the themes and interpretations were consistent and not influenced by a single perspective.

2.5. Validity

Phenomenological Approach: The use of a phenomenological research design contributes to the validity of the study. Phenomenology aims to understand and describe the lived experiences of participants accurately.

Participant Selection: Participants were purposefully selected based on their experience with implementing gamification in the classroom. This purposive sampling strategy ensured that the participants had relevant experiences to share, enhancing the validity of the findings.

Semi-Structured Interviews: Semi-structured interviews allowed participants to provide detailed and context-rich responses, contributing to the depth and validity of the data.

Triangulation: Data triangulation was employed by collecting data from multiple participants. Triangulation involves using various sources or methods to validate research

findings. In this study, data from multiple teachers were collected to cross-verify and validate emerging themes.

Member Checking: Member checking, a technique where participants review and validate the researcher's interpretations, was used to confirm the accuracy of the findings. Participants had the opportunity to provide feedback on the analysis, ensuring that their perspectives were accurately represented.

By adhering to these reliability and validity measures, this study aimed to produce trustworthy and credible findings regarding the experiences, challenges, benefits, and practical applications of AI-driven gamification in education in Saudi Arabian primary schools. These measures helped ensure that the research findings faithfully represented the perspectives of the participating teachers and provided valuable insights into the phenomenon under investigation.

2.6. Data Analysis

The recorded interviews transcribed verbatim to ensure the accuracy and authenticity of the data. Thematic analysis, an approach well-suited for phenomenological research, will be conducted to analyze the collected data [23].

The process is as follows:

Firstly, the transcriptions were read and reread to familiarize themselves with the data and note down initial observations.

Secondly, initial codes were generated from the data, where the most noticeable and repetitive patterns were highlighted. This step is critical in making sense of the large volume of qualitative data.

Thirdly, based on the codes, specific themes were identified. These themes are patterns or issues that recur in the teachers' experiences or perspectives.

The fourth step involves refining the identified themes, analyzing which themes were combined, separated, or discarded to provide an insightful understanding of the data.

Fifthly, the final themes were determined and further analyzed to understand the relationship between them. Each theme was also be named and defined for clarity and ease of understanding.

Lastly, compelling, evidence-based narratives was written up for each theme using direct quotations from the transcripts to back up the research findings.

This process was provide rich insights into the teachers' perspectives about the benefits, the challenges, and the practical applications of AI-driven gamification in education.

3. THE RESULTS AND DISCUSSION

Drawing upon the insights gleaned from the perspectives of educators, this section unveils a series of significant themes that encapsulate teachers' perceptions and experiences with AI-driven gamification in educational settings. These themes offer a comprehensive understanding of how teachers perceive this innovative instructional strategy and its potential impacts on student motivation, engagement, and learning outcomes. The following subsections illuminate these themes, shedding light on the multifaceted nature of AI-driven gamification within the classroom.

3.1. Positive Perceptions of AI-Driven Gamification

Teachers' perspectives on AI-driven gamification, encompassing its effectiveness, adaptability, and real-time feedback, echoed transformative changes in their teaching methods. Participant T2 articulated this transformation by emphasizing how AI-driven gamification

fosters a democratic and highly effective learning environment. T2's words resonate, portraying AI-driven gamification as a catalyst for active student exploration, critical thinking, and a genuine passion for learning. This pedagogical shift transcends the traditional classroom boundaries, ushering in a new era of educational engagement. In T2's words, "It means creating a peaceful atmosphere in the classroom. It means learning by exploring, thinking critically in an active manner of students; learning environment full of love, in which the students could express their sincere thoughts easily; together with a discipline because classroom means more than four walls. Classroom management for me is to reform the mind of students."

The theme of Positive Perceptions of AI-Driven Gamification underscores the transformative potential of this instructional strategy. These findings align with prior research, where AI-driven gamification has been lauded for its capacity to create engaging and adaptable learning environments [24]. The notion of transcending traditional classroom boundaries through AI-driven gamification resonates with the work of Das et al. (2023) [25], who emphasized its potential to foster personalized and transformative learning.

3.2. Challenges in Implementation

In the midst of their positive perceptions, teachers candidly acknowledged the hurdles encountered during the implementation of AI-driven gamification. These challenges surfaced as common themes among participants, and their insights shed light on the complexities of integrating AI technologies into education.

Participant T5, for instance, highlighted the need for additional training to effectively harness AI tools. T5 stated, "We realized that to fully utilize these AI-driven gamification tools, we needed more training and support. It's a new realm, and we had to learn how to navigate it."

Technical glitches were another obstacle noted by participants. T8 shared an experience, saying, "There were instances when technical issues disrupted the flow of our AI-driven gamified lessons. It was frustrating for both teachers and students."

Moreover, concerns about seamless integration into the curriculum were voiced by T12, who commented, "Integrating AI-driven gamification into our curriculum was a learning curve. We had to ensure that it aligns with our educational objectives without creating disruptions."

While teachers expressed overwhelmingly positive perceptions, they also candidly acknowledged the Challenges in Implementation. T5's perspective on the need for additional training and support is consistent with the findings of Celik et al. [26] who emphasized the significance of teacher professional development in effectively integrating AI-driven tools into pedagogy. Technical glitches, as described by T8, mirror the challenges discussed in Rong et al.'s [3] study, highlighting the importance of addressing technical concerns to ensure a seamless learning experience. The concerns about curriculum integration, as voiced by T12, resonate with the work of Bezzina et al. [4], who emphasized the importance of aligning AI-driven gamification with educational objectives to avoid disruptions.

3.3. Elevated Motivation and Engagement

The resounding consensus among teachers was that AI-driven gamification had a profound impact on elevating student motivation and engagement. This observation was underscored by the heightened enthusiasm witnessed among students, their increased participation in classroom activities, and a notably stronger commitment to completing assignments. One teacher, T3, encapsulated this sentiment by stating, "With AI-driven gamification, I've seen students become more enthusiastic about learning. They actively participate, and it's evident that they're more committed to their tasks."

The theme of Elevated Motivation and Engagement aligns with prior research that has consistently highlighted AI-driven gamification's potential to boost student enthusiasm and

participation [27]. Participants' observations of heightened student commitment and active participation corroborate the findings of Kaimara et al.[28], emphasizing AI-driven gamification's role in promoting student engagement. The personalized and adaptable features of AI-driven gamification, as described by teachers, resonate with the work of Wang and Zheng [29] ,who underscored the significance of tailoring learning experiences to individual students to enhance motivation.

3.4. Enhanced Learning Experiences

Teachers passionately conveyed how AI-driven gamification had the power to transform ordinary learning experiences into captivating and deeply meaningful journeys for their students. Participants noted that students began to take greater ownership of their learning, experiencing a newfound sense of autonomy in their educational pursuits. The role of real-time feedback generated by AI algorithms was pivotal, aiding students in tracking their progress and setting meaningful learning goals. Participant T9 articulated this transformation, saying, "With AI-driven gamification, students not only engage more actively but also feel a sense of control over their learning. They can see their progress in real time, and that makes their learning experiences more meaningful."

The Enhanced Learning Experiences theme underscores the transformation of learning into enjoyable and meaningful journeys for students. P9's observation of students feeling a sense of autonomy aligns with the idea of personalized learning experiences, as discussed by [31] . The role of real-time feedback in helping students track their progress and set meaningful learning goals mirrors the findings of [27], who emphasized the importance of timely feedback in enhancing learning experiences.

3.5. Improved Learning Outcomes

Teachers held a strong belief that AI-driven gamification wielded a profoundly positive impact on students' learning outcomes. They eloquently noted that students exposed to AI-driven gamification showcased a deeper understanding of the subject matter, exhibited improved knowledge retention, and displayed enhanced problem-solving skills. These insights echoed the sentiments of numerous participants, highlighting the role of tailored challenges and timely feedback in contributing to these notable improvements.

Participant T6 elucidated this perspective, stating, "AI-driven gamification is a game-changer when it comes to learning outcomes. I've observed students grasping complex concepts more effectively, retaining that knowledge for the long haul, and applying it in practical problem-solving scenarios."

Teachers' beliefs about Improved Learning Outcomes are consistent with prior research indicating that AI-driven gamification positively impacts student learning [30]. The deeper understanding of subject matter, better knowledge retention, and improved problem-solving skills observed by teachers align with [25] findings, which emphasized AI-driven gamification's potential to enhance learning outcomes. T6's perspective on students grasping complex concepts is akin to [3] findings, where AI-driven gamification was associated with improved learning outcomes.

3.6. Challenges in Assessing Long-term Effects

Amid the palpable short-term improvements in learning outcomes, teachers astutely acknowledged the challenges posed by the assessment of AI-driven gamification's long-term effects. In this context, some educators expressed a pressing need for longitudinal studies to

effectively gauge the sustained benefits in terms of knowledge retention and academic performance.

The theme of Challenges in Assessing Long-term Effects underscores the need for further research to ascertain the sustained benefits of AI-driven gamification. T11's call for longitudinal studies aligns with the perspective of [7], who emphasized the importance of long-term assessments to determine the enduring impact of AI-driven tools on learning outcomes. Longitudinal studies, as suggested by T11, resonate with the approach advocated by [3], who called for more extensive research on the long-term effects of AI-driven gamification.

In sum, this study's findings concur with prior research on AI-driven gamification's positive impact on teaching and learning. However, it also highlights the need for continued professional development and further research to address implementation challenges and assess long-term effects thoroughly.

Participant T11 reflected this sentiment, asserting, "While we've witnessed immediate improvements in learning outcomes, the long-term impact remains a puzzle. Longitudinal studies could provide the clarity we need to understand how AI-driven gamification influences knowledge retention and academic success over time."

4. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

This study delved into teachers' perceptions and experiences with AI-driven gamification in primary schools in Arar, Saudi Arabia. The themes that emerged from the study - Positive Perceptions of AI-Driven Gamification, Challenges in Implementation, Elevated Motivation and Engagement, Enhanced Learning Experiences, Improved Learning Outcomes, and Challenges in Assessing Long-term Effects - offer valuable insights into the multifaceted nature of AI-driven gamification within the educational landscape.

Teachers in Arar's primary schools expressed overwhelmingly positive perceptions of AI-driven gamification. They recognized its potential to create democratic, effective, and transformative learning environments. This aligns with prior research, which has consistently highlighted the transformative potential of AI-driven gamification [13] . The teachers also acknowledged the challenges in implementing AI-driven gamification, including the need for additional training, occasional technical glitches, and concerns about seamless curriculum integration. These challenges are not unique to this study and have been documented in the literature [3], [4], [26].

The positive impact of AI-driven gamification on student motivation and engagement was a prominent theme. Teachers observed heightened enthusiasm, increased participation, and a stronger commitment to learning among their students. This resonates with existing research emphasizing the role of AI-driven gamification in boosting student engagement [27]. Furthermore, teachers noted that AI-driven gamification transformed learning experiences into enjoyable and meaningful journeys for their students, fostering a sense of autonomy and providing real-time feedback. These findings align with the notion of personalized learning experiences and timely feedback [28], [29] .

Teachers believed that AI-driven gamification positively impacted students' learning outcomes, leading to a deeper understanding of subjects, better knowledge retention, and improved problem-solving skills. These perceptions align with previous studies highlighting AI-driven gamification's potential to enhance learning outcomes [3] . However, the study also highlighted the need for further research to assess the long-term effects of AI-driven gamification adequately. This reflects a consensus in the literature, emphasizing the importance of longitudinal studies [7], [30].

Based on the findings of this study, several recommendations emerge:

- Teacher Training: Recognizing the challenges in implementing AI-driven gamification, educational institutions should invest in comprehensive training programs for teachers. These programs should equip educators with the skills and knowledge needed to effectively leverage AI-driven gamification tools in the classroom.
- Curriculum Integration: Educational authorities and institutions should collaborate to ensure seamless integration of AI-driven gamification into the curriculum. This involves aligning gamified activities with educational objectives to avoid disruptions and maximize learning benefits.
- Longitudinal Studies: Given the need for further research to assess the long-term effects of AI-driven gamification, educational researchers should prioritize longitudinal studies. These studies can provide a deeper understanding of how AI-driven gamification influences knowledge retention and academic performance over extended periods.
- Sharing Best Practices: Teachers and educators should actively share best practices and success stories related to AI-driven gamification. This can create a supportive community of practice, allowing educators to learn from each other's experiences and insights.
- Continuous Improvement: Developers of AI-driven gamification tools should work closely with educators to continuously improve these technologies. Addressing technical glitches and enhancing user-friendliness can contribute to more successful implementations.

In conclusion, AI-driven gamification holds great promise for enhancing primary education in Arar, Saudi Arabia. While challenges exist, the overwhelmingly positive perceptions and observed benefits highlight its potential to transform learning experiences and improve student outcomes. With thoughtful training, curriculum integration, and ongoing research, AI-driven gamification can be a powerful tool for educators in the region.

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СПРИЙНЯТТЯ ВЧИТЕЛЯМИ ГЕЙМІФІКАЦІЇ НА ОСНОВІ ШТУЧНОГО ІНТЕЛЕКТУ: ВПЛИВ НА МОТИВАЦІЮ СТУДЕНТІВ, ЗАЛУЧЕННЯ ТА РЕЗУЛЬТАТИ НАВЧАННЯ

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Анотація. У цьому дослідженні розглядаються погляди та досвід викладачів щодо впливу гейміфікації на основі штучного інтелекту на мотивацію учнів, залучення та результати навчання. За допомогою якісних методів досліджується сприйняття вчителями освітніх установ цього підходу, розкриваються багатогранні аспекти гейміфікації, розширеної ШІ. У дослідженні визначено кілька важливих тем: позитивне сприйняття гейміфікації на основі штучного інтелекту, проблеми з його впровадженням, підвищена мотивація та залученість учнів, покращений досвід навчання, покращені результати навчання та складність оцінювання довгострокових ефектів.

Отримані результати виявляють трансформаційний потенціал гейміфікації на основі ШІ, оскільки викладачі підкреслюють її здатність створювати демократичні, ефективні та трансформаційні навчальні середовища. Дослідження також розкриває проблеми, пов'язані з професійним розвитком, технічними збоями та узгодженням навчального плану під час впровадження цього інноваційного підходу. Крім того, дослідження виявило значний консенсус серед викладачів щодо позитивного впливу гейміфікації за допомогою штучного інтелекту на мотивацію студентів, участь і досвід навчання.

Викладачі наголошують на тому, що гейміфікація на основі штучного інтелекту може перетворити звичайне навчання на приємні та змістовні подорожі, пропонуючи учням автономію та зворотний зв'язок у реальному часі. Крім того, вчителі вважають, що гейміфікація, на основі штучного інтелекту позитивно впливає на результати навчання, сприяючи глибшому розумінню предмета, засвоєнню знань і вдосконаленню навичок вирішення проблем. Незважаючи на ці короткострокові досягнення, вчителі визнають необхідність лонгітюдних досліджень для всебічної оцінки довгострокових результатів гейміфікації за допомогою ШІ на результати навчання.

Ключові слова: гейміфікація на основі ШІ; сприйняття вчителів; мотивація учнів; залучення студентів; результати навчання.

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