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RESEARCH ARTICLE

AI-Driven Adaptive Learning in Higher Education: A Systematic Review of Dynamic Learning Pathways

Sun Jiali[1], Du Ruixue [2*] , Feng Lu [3]

[1]Assistant Lecture in School of Marxism, Shanghai Jian Qiao University, Shanghai, China
[2]Social Worker in Qingpu Branch of Zhongshan Hospital Affiliated to Fudan University, Shanghai, China
[3]Master of International Studies in the Department of Public and International Affairs, City University of Hong Kong, Hong Kong, China
[3]Assistant Lecture in Facutly of Marxism, Guangzhou Huali College, Guangzhou, China

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***Corresponding Author:**

Du.ruixue@qphospital.com

ABSTRACT

The incorporation of artificial intelligence (AI) within education, especially with regard to gamification, is transforming education at the tertiary level by making it more active and personal. Gamification, that is the use of game design elements in non-game applications, especially the education sector, is an AI-fueled enhancement that aids learners' motivation, engagement, and performance. This work is a systematic review and seeks to analyze the AI dependent gamification in education and its effects in the engagement of personalized learning pathways. During the search, several academic databases were screened according to systematic review protocol developed by PRISMA. The search process employed a series of keywords relevant to AI-enhanced gamification, individualist education and academic institutions. 16 research articles published in peer-reviewed journals were chosen upon application of strict inclusion and exclusion criteria for the purpose of this exploration. The results from these studies have been combined and evaluated across studies in order to assess the influence of AI-linked gamification on engagement and motivation levels of students as well as their academic performance. According to the review, gamification through artificial intelligence enhances the student's motivation and engagement as it customizes the learning experience, providing timely feedback and presenting challenges specific to this way of learning. These learning pathways have led to an increase in academic performance. In addition, other challenges were also recognized including the aspect of increasing stress among students and the challenges associated with the introduction of AI installed systems due to technology and infrastructure inadequacies. The integration of game mechanics in an education system will reshape higher education without a doubt, owing to the ability to create learning experiences that are age and interest appropriate. The article discussed advantages and disadvantages of gamification with artificial intelligence and noted that more effort should be directed towards dealing with technology and ethical issues in order to sustain its fairness.

INTRODUCTION

Artificial Intelligence (AI) can be viewed as one of the primary agents of change in many sectors in the technology and its application in higher education is causing a major disruption. Decade back, AI couldn't be thought of anything beyond a supportive tool for teaching and learning as it has come with more advanced and ingenious means of making the learning experience more enjoyable and

effective by introducing the concept of personalized learning. AI is being applied to understand student behaviors, monitor their achievements, and not only provide information but also adjust it depending on the responses of the learners to ensure the most appropriate learning experience for each individual. This kind of flexibility improves the students' self participation but also positively contributes to the quality of the learning through understanding and remembering the material in a more sophisticated way (Benzizoune, 2024).

Additionally, one of the crucial factors for the successful deployment of AI in higher education is its cooperation with gamification. Gamification has been defined as the use of game design elements such as points, badges, leaderboards and challenges in non-game contexts, it has been found out to be helpful in increasing and keeping students engaged. Gamified learning pathways provide such an interesting appropriate solution to the engagement of the learners in higher education where it is difficult to sustain the motivation of the learners. For example, there was a case study with more than 2,500 students within a gamification environment built into the e-learning management system Moodle that led to increase in the levels of participation and satisfaction although did not eliminate all problems associated with the delivery of the course content (Barna & Fodor, 2017).
Over 450 students were included in one more study which indicated that when gamification was instituted in a technical higher education course, first attempt pass rate reached over 75% as well as enhanced participation, improved classroom engagement and favorable ratings from learners (Iosup & Epema, 2014). These results point out the influence of the gamification of learning through AI in promoting engagement and achievement of the students. Dynamically adaptive learning is increasingly becoming more important due to the differences in the learning styles of different individuals. In higher education in particular, the so-called "one size fits all" practices rarely serve the intended purpose. In real time, feedback-driven AI systems can adapt the difficulty, speed, and kind of materials presented to the learner. For instance, it has been established that the use of AI-driven gamification tools offers student's motivation and engagement, with the students' performance rates and comprehension of the alternated academic content enhancing (Alenezi, 2023). Moreover, given that most Americans, 67% to be precise, are gamers, gamified methods are fast gaining ground in higher education, particularly in the areas of engagement and recruitment (Johnson & Goncalves, 2018). This tendency is on the rise which means that AI driven gamification will be in use more than it is now, and so this is a topic that should be stressed by educators and institutions.

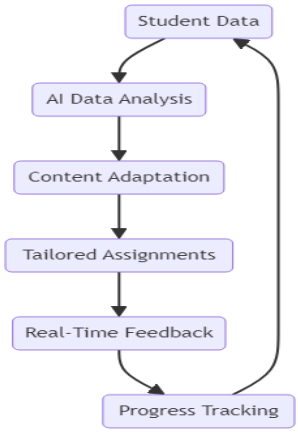

Figure1: illustrates the iterative process of AI-driven learning pathways, showing how real-time feedback leads to adaptive content adjustments, a key contributor to improved student engagement and academic success.

This review also aims to answer the following research questions:
RQ 1. How does the integration of AI-driven gamification impact student engagement and motivation in higher education?

RQ 2. In what ways does AI-driven gamification create dynamic, personalized learning pathways for students?

RQ 3. What are the key benefits and challenges of using AI to adapt gamified learning experiences in real-time based on student performance?

This particular review makes effort to bring together and assess the relevant current literature that addresses implementation of gamification in learning through artificial intelligence in higher education Setting. The primary aim is to look into the advancements in technology and their implications in the transformation of learning environments and their influence on students' participation, motivation and performance in studies. Therefore, having examined this literature, this review provides therefore an overview of the enhancement, limitations, and perspective of gamifying higher learning using artificial intelligence, especially on the importance of developing interest-filled responsive systems for the users.

METHODOLOGY

This systematic review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework to guarantee openness and reproducibility during all steps of the review. The review's main objective is to assess the influence of gamification techniques powered by Artificial Intelligence (AI) in the formulation of their learning pathways amongst learners in higher education. In this regard, the following four steps were fervently taken into consideration.

Step 1: Identification

The identification phase was concerned with the search of studies on AI-enabled gamification in the context of higher education. The researcher conducted a systematic search of major relevant sources including Google Scholar, Web of Science, Scopus, and IEEE Xplore with the help of relevant keywords and Boolean operators for articles published between 2014 and 2024. The terms used in the search include "AI-driven gamification," "dynamic learning pathways," "adaptive learning," and "higher education." In order to polish the search, the researcher used Boolean operators to add education games using AI and remove studies that are not related to education games using AI. The studies that were found were then arranged for further processing and sifting.

Step 2: Screening

After the completion of the identification phase, relevance of 43 selected studies was revisited. Reviewers in pairs independently assessed the titles and abstracts of the studies to determine whether they fulfilled the initial eligibility criteria which required the studies to focus on the application of AI gamification in higher education only. Studies that were not connected to Artificial Intelligence, gamifying strategies or immersive learning environments were filtered out. All controversies among the reviewers were settled based on discussion or through the third reviewer. Studies which did not meet the specific inclusion criteria were not considered further at the eligibility phase.

Step 3: Eligibility Criteria

The eligibility criteria were developed in accordance with the aims and objectives of the review. The studies were assessed according to the following benchmarks. (Brony et al., 2024).

Step 4: Inclusion Out of the studies that were eligible, the authors analyzed only the numbered studies in detail. We used a peer-reviewed data collection template to gather relevant data from such studies, including study design, sample, intervention, outcome, and results. Also, a PRISMA flow chart was provided as a visual show of how the studies were included (Figure 1).

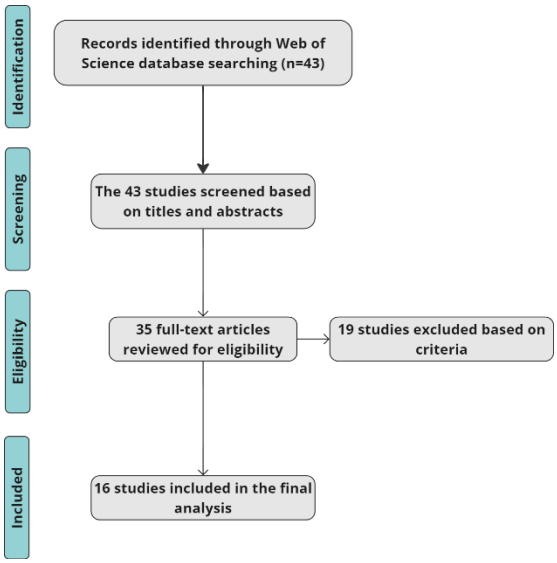

Figure 2: PRISMA Flow Diagram

Table 1: Inclusion and exclusion criteria used during the eligibility screening process

Criteria	Inclusion	Exclusion
Timeframe	Studies published between 2014 and 2024	Studies published before 2014
Peer-Reviewed	Peer-reviewed journal articles, conference proceedings	Non-peer-reviewed articles, preprints, grey literature
Focus Area	AI-driven gamification in higher education, adaptive learning pathways	Studies unrelated to AI or gamification
Language	English or translatable to English	Non-translatable languages

Search Strategy

The search strategy for this systematic review was designed using a combination of targeted keywords and Boolean operators to ensure comprehensive coverage of relevant literature. This approach involved constructing complex keyword queries to retrieve studies specifically related to AI-driven gamification in higher education. Below is an outline of the search strategy and the list of keywords employed across different databases (Table 2).

The search terms used in this strategy included specific phrases related to AI-Driven Gamification, such as "AI-Driven Gamification" and variations of related concepts like "Artificial Intelligence in Gamification" and "AI-based Gamified Learning." This ensured the focus remained on AI-based interventions in education, particularly those incorporating game-like elements to enhance learning outcomes.

To target the relevant educational settings, the search terms were broadened to cover contexts in Higher Education and related educational environments, including "University," "Tertiary Education," and other variations like "Post-secondary Education." These terms ensured the inclusion of studies from various types of higher education institutions.

In addition to the educational context, keywords related to Dynamic Learning Pathways and personalized learning methodologies were incorporated to refine the search to relevant studies focusing on adaptive and customized learning models. Terms such as "Dynamic Learning Pathways," "Adaptive Learning," "Personalized Learning," and "Customized Learning" were used to retrieve studies that discuss the customization of learning experiences through AI-driven gamification.

Boolean operators were essential for narrowing or expanding the scope of the search. For instance:

- **AND** was used to ensure the results combined all essential elements, such as "AI-Driven Gamification" AND "Higher Education" AND "Dynamic Learning Pathways," resulting in studies specifically discussing AI-based gamification applied in higher education settings with a focus on personalized learning paths.
- **OR** helped broaden the scope to include variations in terminology, such as "Higher Education" OR "University" OR "Tertiary Education," ensuring a comprehensive collection of studies from different academic environments.
- **NOT** was employed strategically to exclude irrelevant studies, such as those discussing primary or secondary education, thereby refining the search to focus only on tertiary education.

Table 2: The summarized search strategy and keywords for Databases

No.	Construct	Search Field/Limitations
#1	"AI-Driven Gamification"	Topic-based search in all selected databases
#2	"Higher Education" OR "University" OR "Tertiary Education"	Topic-based search
#3	"Dynamic Learning Pathways" OR "Adaptive Learning" OR "Personalized Learning" OR "Customized Learning"	Topic-based search
#4	2014 – 2024	Time period for publications
#5	#1 AND #2 AND #3 AND	Combination of constructs for refined search

Search Methodology: this study was developed through three main stages: 1) Identification and finalization of studies of potential interest, 2) Application of strict inclusion and exclusion criteria to the chosen set of research articles, and 3) Content analysis of the selected studies including those studies that diversified the conducted research on the topic that was inclusive (Jiaqing et al., 2023).

Data Extraction and Analysis

For the purposes of data extraction and analysis, a range of studies focused on AI-facilitated gamification in higher education were explored with respect to several parameters. To begin with, we established the specifics concerning the categorization of AI-based gamification innovations that include, but are not limited to, the personalized learning pathways and dynamic game mechanics among others. The context of the study within the research was understood better by looking at participant characteristics such as age, academic level and field of study.

Some of the parameters that were analyzed in determining academic performance included grades, GPA, and student engagement. The results showed both good and bad sides – even though most of the studies showed that the use of gamification for educational purposes using AI resulted in more motivation, engagement, and performance within students, some studies pointed out the adverse effects of AI gamification like some students becoming more stressed or even withdrawn.

In sum, the review appreciated the merits and demerits of AI technology in gamifying higher education which illustrated both qualitative and quantitative approaches to finding consistencies and inconsistencies in the existing literature. After the completion of the research on gamification using artificial intelligence technology in higher education, a content analysis will also be performed to

measure the effectiveness of the technology on the learning achievements of the students as was done by Brony, Alivi, Syed, Dharejo et al. (2024).

RESULTS

The use of AI-powered gamified elements within the scope of higher educational systems has contributed positive and quantifiable outcomes on students' motivation and engagement. With the increased application of AI technologies in education, research has revealed that AI powered gamification methods embrace active and engaging learning experiences for the students.

AI-enhanced tools increase student motivation and engagement

High levels of student engagement have been proven to occur when education tools are integrated with the needs of the students with the help of technology and especially gamification. An excellent instance of this is in the work conducted by Sawarkar et al. (2024) where the authors noted that students interacting with AI powered and gamified learning systems tend to engage more with the system. This heightened interaction was seen in various aspects like increased participation in class, higher turn-up rates, and better concentration on coursework. Instead, the tools equipped with AI offer something more interesting, an online experience where they keep feedback inline and vary the difficulty of tasks according to individual student performance lending itself to the learning process.

Moreover, Correia et al. (2024) remarked that gamification in education with the use of artificial intelligence promotes critical thinking as it provides learning experiences that are unique to the context. However, because, interviewed, the machine learned that each one of them had a different trajectory and generated different challenges within its limits. This sort of situational appropriateness is essential for keeping students' interest sustained. Remaining within the zone of proximal development was difficult, since some students were not given tasks that were simple enough and some received very hard challenges. Activating and sustaining motivation in this scenario is also to be enhanced because the right amount of challenge is always provided for all pupils using such technologically advanced resources thereby making learning better and more pleasurable. Moreover, the immersiveness of AI-assisted in game problem solving further augments intrinsic motivation. Learners are not only more active, but appreciate the content more, as they implement the information in realistic contexts. That is, how many studies have shown (Sawarkar et al., 2024; Correia et al., 2024) that effective self-assessment and adjusting to the environment for a specific purpose, including action stimulates and does not defocus the willingness to engage in learning activity for a long time.

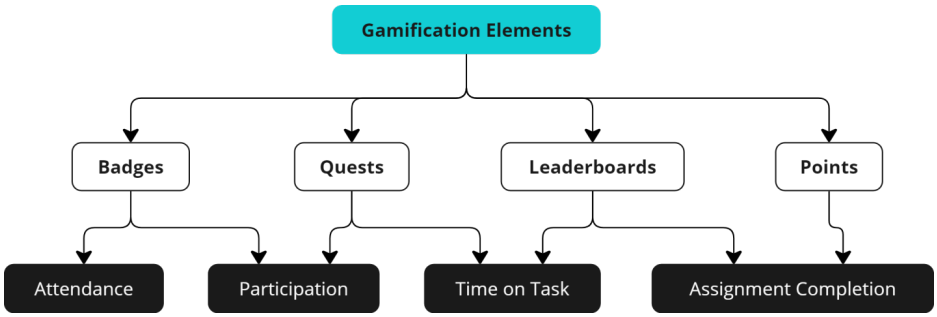

Figure 3: illustrates the relationship between different gamification elements and student engagement metrics.

Personalized learning pathways show improvement in academic performance

Besides enhancing engagement as well as motivation, AI-controlled self-driven educational routes were specifically designed to improve academic performance. AI instruments are conceptualized such that they assess the status of a student in the process of learning and report the height that has been reached, the low areas that require help, and the hovering mid-areas. Most of the time, school environments do not accommodate such a kind of learning, therefore, this approach enables

educators to integrate external factors which alter the learning experience and dynamics one is subjected to, making learning more efficient.

As per Benzizoune (2024), reported the implementation of personalized learning pathways through artificial intelligence powered systems highly improved the academic performance of the students. For instance, the students using these systems were exposed to learning materials and practices, which specifically focused on the weaknesses of the students with such targeted learning interventions. At the same time, students with high achieving abilities were allowed to progress through learning content in a much shorter time to keep them focused and avoid boredom. This approach also covers adaptive assessment where students are able to express their level of understanding in the formats that best suit their style and level. The systems have AI that monitors every student and their progress and offers insights timely so that those behind are helped quickly. Because of such a proactive approach, who seek to use pole vaulting solutions for struggling students, AI systems enable such teachers to identify these knowledge gaps early and provide extra resources or different ways of teaching to such students, ensuring they not just pass but achieve their potential. Furthermore, the individualized method which is advocated by platforms powered by artificial intelligence not only enhances the academic results but also contributes to higher levels of student satisfaction. Students claim that they feel a sense of support and understanding during the learning process as there is a structure that takes into consideration each student's learning style and preference. In conventional education systems, such a degree of customization is almost impossible to achieve, thus explaining the growing importance of AI systems in today's universities. To sum it up, AI-based games and tailored education programs for each user are revolutionizing the sphere of higher education since they increase students' motivation and performance. It can therefore be anticipated that the influence of these technologies on education as they mature will go beyond the present scope and help in the creation of more flexible, appealing and highly productive learning.

Here is a table 3 summarizing the most recent studies discussing the impact of AI gamification on higher education:

Title	author	Year	Summary	Study design	Population characteristics
Leveraging AI to Transform Online Higher Education: Focusing on Personalized Learning, Assessment, and Student Engagement	Abhay Bhatia.	2024	The paper explores how artificial intelligence (AI) can transform online higher education by focusing on personalized learning, AI-driven assessment, and student engagement.	Systematic review	Not mentioned
Enhancing Classroom Management and Student Engagement: The Role of ClassDojo	Ouafae Benzizoune	2024	This study explored the effects of integrating the AI-enhanced gamification platform	Qualitative case study, conducted in a single 6th-grade classroom of 25 students over 4 months, with direct	- 25 students in a 6th-grade classroom - Ages 10-11 years old

and Gamification in Education			ClassDojo on classroom management and student engagement in a 6th-grade classroom, finding significant improvements in student behavior, self-regulation, and motivation.	classroom observations by the researcher/teacher.	
Empowering the Faculty of Education Students: Applying AI's Potential for Motivating and Enhancing Learning.	Amr M Mohamed.	2024	This study investigated the impact of AI on students' intrinsic motivation and learning experiences across different cultural and academic settings, finding that AI-powered learning tools positively influence motivation and learning, with variations based on nationality and major, but not academic level.	The study design was a cross-sectional, non-experimental, observational study using a survey-based approach to examine the relationships between AI-driven learning aids, intrinsic motivation, and learning outcomes across diverse student groups from four different countries.	- Gender: 57.8% female, 42.2% male - Majors: Primarily English as a Foreign Language (28.1%) and Primary Education (26.6%) - Academic levels: Diverse distribution across freshmen (27.9%), sophomores (14.1%), juniors (22.9%), and seniors (35.2%) - Nationality: Largest groups were Egyptian (31.9%), Saudi (25.5%), Spanish (24.6%), and Polish (18.0%)
Teacher perspectives on AI driven gamification: impact on student motivation, engagement, and learning outcomes.	Abdullah Alenezi	2023	This study explores teacher perspectives on the impact of AI-driven gamification on student motivation, engagement,	The study design is a qualitative phenomenological study involving semi-structured interviews with 15 purposefully selected teachers from primary schools in Arar,	- Teachers working in primary schools in Arar, Saudi Arabia - Selected based on their experience with implementing gamification in the classroom

			and learning outcomes, finding that teachers perceive it as having transformative potential but also face challenges in implementation.	Saudi Arabia who have experience with implementing gamification in the classroom.	
The Next Chapter of ELT: Embracing AI-Infused Pedagogies and Evolving Educational Strategies in the Post-Pandemic Landscape	Eva Mark C.Abrenilla	2023	This paper presents a comprehensive analysis of the integration of Artificial Intelligence (AI) in English Language Teaching (ELT) from 2020 to 2023, exploring its transformative impact on language education and the associated challenges.	The study design is a systematic literature review on the integration of AI in English Language Teaching (ELT) from 2020 to 2023.	Not mentioned
An Empirical Study on the Use of Gamification on IT Courses at Higher Education	Balázs Barna,	2017	Gamification can improve student engagement and course outcomes in IT education, though it cannot solve all problems in education.	An observational study of a gamified IT course at a university, involving over 2500 students.	- Undergraduate students at Corvinus University of Budapest - Majoring in business and economics - Belonging to Generation Y (born mid-1980s to mid-1990s) and Generation Z (born mid-1990s to early 2000s) - Both full-time and part-time students

DISCUSSION

1. AI-Driven Gamification: A New Era in Education

1.1. Definition and characteristics of AI-driven gamification

When gamification is explained with the usage of AI, it means the use of game design elements such as points, rewards, and challenges, boards among others, with the help of AI for better interaction in lectures. The most important aspect attached to distance education gamification implemented using artificial intelligence AI in other than ludic purposes is the use of game boundaries mechanisms). AI based solutions monitor the engagement and progress of the learner and modify the subjects and even the mechanics of the games to fit the preferences of taught individual. For instance, if the learner is doing very well, the AI can step up the game by adding stiffer challenges but if the learner is found wanting, the AI can curtail the challenge to give the learner some additional help or simpler activities to bridge the gap. This ensures that individual learning curves are continuously respected, which kept the students active through all the learning processes. This is because all the learning experiences concerned are tailored to their age and abilities.

AI-enabled gamification – as opposed to simply adding games to the teaching of someone on something – is a paradigm change with regards to learning and education for it is more geared towards understanding the clients' needs. One of the best features of AI is that makes it possible to carry out detailed investigation of data on the go, to this end learners mood states can be manipulated and stimulated in order to have each learner engaged at his or her skill level to maximize motivation and retention of content. With the emergence of various gamification features associated with advanced AI technologies, aspects of education such as augmented learning systems offer a myriad of opportunities.

1.2. Evolution of gamified learning environments with AI integration

Over the years, the development of gamified learning environments has steadily incorporated AI technologies. At first, gamification was limited to superficial aspects such as points and badges which meant there was some increase in student motivation but no individual attention to the students. With the introduction of Artificial Intelligence technology, these gamified learning environments have become fluid, changing as the student progresses in real-time. For instance, today, adaptive learning systems have AI aligned to levels of tasks, adjusting them to different learners, providing immediate feedback and presenting challenges which makes the learning process more interesting and productive (Correia, 2024).

AI adoption in the education sector has impressed many as gamification triumphed from a mere engaging element to a so called a values learning factor. Learning environments are adjusted with the help of AI according to each student in such a way that a student is always in the right level of interest and difficulty. All these trends are the signs pointing how fast integrated technology is gaining roots in the education sector making education even more efficient and better avenues for learning.

The use of AI-driven gamification in education is supported by a number of learning theories, most notably Self-Determination Theory (SDT) and theories related to constructivist learning. According to SDT, to increase intrinsic motivation, it is necessary to nurture one's autonomy, competence, and relatedness as a learner. First, AI-driven gamification promotes autonomy when students are free to progress at their own pace; secondly, it promotes competence by making tasks appropriately challenging; and thirdly, it promotes relatedness by facilitating interaction among students within a gamified environment (Alenezi, 2023). In the case of the AI-driven approach, learning theory can be said to be constructive in that students are encouraged to learn by working with the material. Constructivism also supports the use of technologies such as AI because, with the help of technology, motivation can be provided through tasks and challenges that are specific for each student. Hence in AI-driven gamification, education is not merely through information but construction since learners

are provided with active ways of creating knowledge through adaptive tasks and personalized challenges.

Many educational practices are being reshaped by the introduction of AI-driven gamification, which promotes the experience of learning as personalized and adaptive to the needs of every student. This is largely due to the fact that the practice is based on educational theories such as SDT and Constructivism that aim at stimulating management, participation and creative abilities by AI-driven gamification. By enhancing the interaction and responsiveness of the learning environments, it can be predicted that the learning process in higher education will undergo a radical change due to AI where it will be customized to a learner's specific learning needs and pace through educational content.

2. Dynamic Learning Pathways

2.1. Explanation of dynamic learning pathways

Dynamic learning pathways are competence-driven personalized learning methods created by AI systems, which are always reassessed with regards to the student's learning rate and learning style. Unlike conventional progressive learning structures which include the same level of progression for all the students irrespective of their skills or pace, dynamic pathways make adjustments in the course of performance. In online learning, the environment featuring educational content develops dynamic pathways which are driven by AI and can modify content, assessments, as well as feedback. Bhatia et al. (2024) note that disruptive technology enhances learning experiences through adaptive platforms that bridge learning gaps through effective personalized learning interventions; thus, learning does not become overworking or boring.

AI systems tend to multi-dimensionally gauge such elements of a student's learning process as the rate of task performance, error frequency, and number of help requests. The consequences of this are that the learner's inputs are not constant but fluctuate with every change of circumstance. For instance, one AI system can analyze the progress of the particular learner in relation to his/her level of understanding of certain concepts. If that learner has deficiency in understanding the concept, the system may provide simple diagrams, additional explanations and examples, or concepts or engage the learner in practice. In contrast, when the student performs well in a concept, the system may simply present him/her harder exercises or even advance the student to another level. According to Benzizoune (2024), ClassDojo employs AI technology for the convenience of students depending on their actions, which results in better engagement and improved academic performance.

2.2. The use of AI-driven feedback systems for real-time assessment

Students are able to gain insights and act on them immediately, making it possible to learn from failures and develop better comprehension over time. These systems elaborate on feedback by assessing the learner's response to their specific challenges and needs in real time as the learner responds. As an example, Alenezi (2023) illustrates that learning outcomes can be gamified in educational settings and can significantly improve if feedback is provided immediately to assist corrective actions after errors are made. Assessment which is done in this manner refers to the performance monitored and evaluated after every learning activity and is an important aspect of DLP, as it allows students to learn and progress at their own pace in the progressive learning approach.

In summary, the last form of learning presented entails the dynamic learning pathways which are Artificial Intelligence systems has changed the face of individualized learning. These pathways allow content and assessment for each student in accordance with their learning style preferences which increases the effectiveness and enjoyment of the learning process. The integration of AI into academic systems does not only stop at the provision of these pathways as they also include the feedback systems that offer real-time insights into academic activities and enable the students to maintain healthy grading progress.

3. Key Benefits of AI-Driven Gamification

3.1. Enhancing Student Engagement and Motivation

One of the notable advantages that come with AI gamification in learning is the increased student engagement and motivation levels. Such environments where the use of AI modifies the challenges and rewards based on the status of each participant are also effective as they provide additional motivation to the learners who benefit from constant feedback and rewards. It is noted by Benzizoune (2024) that students in AI-assisted gamified classrooms are more self-regulated, motivated, and participative. Education technology, ClassDojo, is an example of an AI-enhanced system that encourages positive behaviors by providing immediate effects, thus fostering participation and improving interactions during classes. In support, Alenezi (2023) noted that due to motivational gamification by AI-based systems, the performing of tasks was matched with the students' personal preferences and capabilities, leading to improved participation.

A specific feature of gamification using AI is personalization. Guided by artificial intelligence, the students' progress is monitored and learning tasks are changed accordingly. Bhatia et al. (2024) discuss how in the field of online education, systems driven by artificial intelligence achieve personalization of learning by considering students' performance data and constructing appropriate learning trajectories for students, while enabling students to progress quickly at their own pace. Such an approach makes certain that all students are catered for in such a manner that none of them is given work that is tedious, or work that is laborious and taggles optimal to any other approach and strategies of teaching being employed to target different learners.

3.2. Improved Critical Thinking and Problem-Solving Skills

It has been found that the AI-Based gamified zones help students to improve their thinking and problem-solving skills due to their involvement in challenging situations similar to those that exist in real life. When using such gamified learning systems, AI systems modify the difficult level of the performed tasks, depending on the level of performance achieved by the student in order to prompt the students to utilize their knowledge and improve their skills in solving problems. As advancing educational technology through artificial intelligence encourages critical thinking by providing an adaptive ex We all have faced challenges that compel us to think critically about a given situation, the decisions we make and even the outcome of the activity as Alenezi (2023) observes. Additionally, Correia (2024) emphasizes the fact that AI adjusts parameters such as the difficulty level of problems in a gradual manner in a bid to enhance the development of more complex hierarchical thinking levels.

Gamified approaches to education assisted by keeping all the underlying drawbacks aside presents several advantages for promoting students' engagement and motivation as well as improving learning outcomes. AI integration in awareness building and skill building through challenge creation enhances critical thinking and problem-solving skills in students through focusing on the tasks. This also results in higher engagement levels because students are constantly kept at the right challenge level which also inspires them and enhances learning experience.

4. AI-Enhanced Tools for Dynamic Learning

In the realm of personalized and self-directed learning, intelligent tutoring systems (ITS) rank among the most advanced tools developed as a branch of artificial intelligence. These systems are also referred to as intelligent virtual tutors that provide an adapted level of instruction based on a student's individual achievements and progress. ITS understands the insufficiency in a student's comprehension and creates relevant feedback, exercises, and helps the student to work on these issues. Additionally, the gamification aspects of ITS, such as awarding prizes or badges for task completion, increase interest in learning by making it more fun (Sawarkar et al., 2024). Intelligent tutoring systems can provide gamified content to learners' needs. Feedback and instruction is provided immediately and in fact, enabling the students to carry out their activities with the knowledge that there are gamified elements present to elicit their interest. Of great significance in this case is the challenge since there is the experience of AI in enabling the creation of individualized assessment of the students' skills through adaptation of the evaluation to the needs of the student.

This assessment system allows for each question to be related to the particular student's experience and the last question answered correctly. For example, if a student is asked a question, gets it correct, then they are likely to be asked a harder question next, but if they are struggling, then an easier question will follow the next. This enables the students to always be at the right level of workload, which makes sure that the students meet the challenge set before them, but they are not swamped by it (Sawarkar et al., 2024). The adaptive assessments using the technology of AI give rise to better methods of assessing the progression of students. The AI does this by moderating performance real time and altering the level of the task being undertaken ensuring that the learner is not overworked or underutilized thus enhancing learning and also improving the assessment of their abilities.

Challenges and Ethical Considerations

Data Privacy Issues:

Ethical issues such as data privacy and algorithmic bias have emerged as a backlash in the higher education sector due to the growing use of AI-powered gamification techniques. AI technology is resource-demanding as it seeks numerous amounts of student data for the purpose of enhancing the learning experience for the students. This approach provokes the issue of data collection, data storage and data usage, secondarily. Some student data, like performance data, histories of interaction, even their actions is applied in AI systems. Nevertheless, in the absence of mechanisms of protection, this information is susceptible to breach, abuse or exploitation. Nevertheless, there should be measures in place to protect the integrity of such information to avoid cases of privacy abuse or information exploitation. Moreover, educational institutions must find ways to protect such data from unauthorized access or abuse by third parties, while also ensuring that their privacy policies are straightforward and comply with applicable laws and ethical considerations. (Correia, 2024).

Algorithmic bias:

Another important issue is ethical algorithm and AI bias. The effectiveness of Artificial Intelligent systems solely depends on the data and algorithms used in their design. Thus, in instances where these systems are trained using data which is biased, be it along racial or gender lines or class, the system may unconsciously reinforce those biases, creating inequalities within the education system. For instance, advanced learning avenues may be generally offering less chances to students from minority groups or may provide them with tailored information that is not suited to their specific learning requirements. These bias mitigation strategies are essential in promoting equity in education that is powered by artificial intelligence (Pfeiffer et al., 2024). In summary, ethical issues such as concerns about privacy of data and biases in AI decision-making processes represent some of the primary obstacles to the responsible adoption of these technologies by the education sector. Institutions must enforce effective data protection measures and regularly assess the impact of the AI systems in order to safeguard the students from any adverse consequences.

The Digital Divide in AI-Driven Education

Another challenge that poses a threat to the fair application of AI-driven gamification in education is the digital divide. Not all students have the same resources – technology, especially the Internet which is vital for AI implementation in learning. This inequality can make the situation worse, for instance, in a gamified setting where a student from a poor family would be actively participating or even competing. Readiness in technology is another aspect that should not be overlooked because some educational institutions may not have the capacity to integrate the AI tools as intended (Benzizoune, 2024). To realize the objective of AI education inclusievly, the efforts to reduce the digital inequality barriers will be very timely. These may entail increasing the availability of the requisite technology to the students, expanding the provision of broadband facilities in the areas with limited scope and most importantly ensuring that the AI based systems are designed in such a way that all the users regardless of their financial capability are able to operate them. Below the line digital divide is a major concern when it comes to ensuring that all students get to reap the benefits brought about by AI led gamification. Otherwise, an appropriate technology to promote the use of AI

in creating flexible and adaptive learning spaces in education would be a dream to the existing education system as deepening the inequality that is in the education system would become unavoidable.

Balancing Extrinsic and Intrinsic Motivation in Gamification

Game-based learning or gamified learning often experiences this challenge since it uses both intrinsic and extrinsic motivation. This type of gamification engages learners through active extrinsic rewards, however, there is a danger that learning becomes an activity solely dependent on these rewards. Learning may be done simply for the sake of it without any ingestion of the content (Pfeiffer et al., 2024). This purely points scored approach demonstrates the need to effectively design gamification elements in learning where the level of extrinsic rewards is motivating but does not displace internal motivation. One way is to create gamified systems where the focus is on how well and how much learning takes place as opposed to performance of tasks alone. Instead of paying a premium to kids for hastening to do their assignments, it is more valuable to reward kids based on their willingness to explore and the potential complexity of the problems they seek to solve (Sawarkar et al., 2024). It is evident that extrinsic and intrinsic motivation have to be kept in equilibrium for technology enhanced learning that is gamified to be successful. AI designs should be such that they promote deeper learning concerning the subject and spark interest in the learning materials themselves, such that students are still engaged even without any external stimuli.

Future Directions and Research Needs

As more and more industries including education embrace AI systems, it is imperative that attention is given to the established guidelines of using the latest technologies within any educational level. In particular, the issue of fairness and access to resources which may be in a form of AI or any other technology to enhance learning should address all students irrespective of their backgrounds. There is a need for pragmatic policies and measures that will ensure such technologies are utilized equitably within the society both in institutions and at the government level. These guidelines must also include guidance regarding some issues such as protecting the privacy of users as well as the fairness of the machines (Correia, 2024). It is important to tackle the issues of creating comprehensive frameworks to guide the implementation of AI in education and challenges that are posed by all the emerging technologies. The importance of this is because it will be in bookerising that every reader irrespective of their social class or geographical location will have adaptive learning in form of AI technology which will enhance their studies.

The successful implementation of AI-driven gamification leaders is directly proportional to how competent and creative the teachers using these technologies are. Too many times in the classroom are AI systems underutilized because the teacher does not possess the knowledge to effectively employ the AI in her lessons. There is an immediate need to institute training programs for the teachers so that they are prepared to employ teaching strategies that incorporate artificial intelligence. It means teaching how teachers can use that information and make changes to their instruction, teach them about how the systems work, including the bias that is built into the systems and how to overcome it (Pfeiffer et al., 2024). Teacher training is another factor that is necessary for the effective incorporation of AI in Education. This guarantees that the advantages of AI to the students will not be selective and also upgrades the standard of education.

Even if the investigations available showed positive aspects with regard to immediate effects of AI Gamification, still other research studies have to be carried out to assess the consequences of AI gamification on learning over a period of time. There are also questions on the ability of such systems to enhance academic performance or even the ability to think properly and solve challenges in the long run. In addition, gamification of learning using AI will require more studies concerning its potential negative issues like excessive dependence on external enforcements of rewards and deepening inequality (Sawarkar et al., 2024). Further investigations should also consider how different educational environments would accommodate the use of AI-enabled gamification, including high-resource and low-resource as well as informal learning environments. Another

important aspect to consider will be how AI technologies can be localized to ensure that this technology is embraced within the education sector. It remains imperative to embark on further research in order to appreciate the extent of influence that AI gamification has on learners' performance in a broader perspective. Educationists are concerned with the assessment of such systems, as it offers the clear potential of using AI for better social equity in education.

CONCLUSION

This systematic review underlines the near-pragmatic possibilities of the gamification of education with the help of artificial intelligence. Due to the presence of artificial intelligence, these gamified learning environments have the ability to create dynamic and adaptive learning pathways for students - and as a result, improve their affiliation, motivation, and even learning outcomes. The fact that AI may facilitate the assessment process by giving feedback during the learning activity as well as scaling down the level of complexity of a particular task in line with a student's achievement makes the learning process more engaging. There are, nonetheless, various issues, which one may refer to as challenges, which require solutions before appreciable utilization of AI-induced gamification can be realized. Some students for example may be less happy or may develop pressure while trying to cope within adaptive learning contexts especially where they are not able to perform well given the quick speed of task identification using automated means. Also, issues regarding data security and algorithmic oppression are and will remain very contemporary dilemmas in the use of AI in education. It is expected that there is a huge aggregate of information collected from students for the purpose of tailoring their learning; failing to put measures in place would expose this information to misuse. There is also the risk that certain groups of students may be discriminated against because particular groups of individuals designed the very AI tools that they use. These concerns underline the need to put in place measures such as comprehensive policies and operational frameworks aimed at promoting equity, accountability, and responsible use of artificial intelligence systems in education.

To sum up, there is an increasing reliance on AI-powered gamification as one way of making the educational experience more interesting and individualised. There are challenges, however the advantages it provides in terms of better learning and higher student engagement justifies that it is one of the areas that will be explored in the future of higher education. With adequate attention to the recalcitrant ethical and technical constraints, AI-facilitated supervision can, and indeed will, transform the learning spaces of the next generation.

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