The Effect of Peer Assessment on Differentiated Instruction Using Gamification in Schools Towards Education 5.0

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Abstract

Education 5.0, the era of personalized learning, emphasizes the importance of personalization, customization, and the use of technology to create engaging and effective learning experiences for all students. This systematic review examines the influence of peer assessment on differentiated instruction (DI) using gamification in schools in the context of Education 5.0. Through a systematic literature review, this study analyzed 17 research articles published between 2019 and 2024, highlighting key findings and supporting studies that demonstrate the transformative potential of peer assessment and gamification in DI. The findings of this study show that the interaction of peer feedback, differentiated instruction, and gamification in Education 5.0 environments enhances student engagement by creating a supportive and stimulating atmosphere. It motivates students intrinsically through meaningful feedback and extrinsically through gamified rewards, encouraging them to take ownership of their learning journey. Moreover, these methodologies promote self-regulation by empowering students to set goals, monitor their progress, and adjust their learning strategies accordingly. In conclusion, the integration of peer assessment, differentiated instruction, and gamification represents a holistic approach to education that prepares students for the challenges of the 21st century. With this approach, schools can create a more inclusive and student-centered learning environment, enabling them to reach their full potential. In addition, this systematic review is expected to be a reference for teachers, schools, and other education professionals to improve the quality of education in the future.

Keywords: peer assessment, differentiated instruction, gamification, school, Education 5.0.

Introduction

In the dynamic landscape of education, the quest for innovative and effective teaching methodologies remains paramount. As we transition towards Education 5.0, a paradigm that emphasizes personalization, technology integration, and lifelong learning, the role of peer assessment and differentiated instruction using gamification has gained significant traction. This paper delves into the intricate relationship between these pedagogical approaches, exploring their potential to enhance student engagement, promote deeper understanding, and foster a holistic learning environment aligned with the tenets of Education 5.0.

Peer assessment, a student-centered approach that involves evaluating the work of peers, has garnered widespread recognition for its multifaceted benefits. According to Taylor (2019), peer assessment fosters self-awareness, critical thinking, and communication skills, empowering students to become active participants in their learning journey. Furthermore, Topping (2017) highlights the role of peer assessment in promoting metacognition, enabling students to develop a deeper understanding of their strengths, weaknesses, and learning processes

Differentiated instruction, a teaching strategy that caters to individual student needs and learning styles, has

emerged as a cornerstone of effective pedagogy. Tomlinson (2021) emphasizes that differentiated instruction empowers educators to tailor instruction to the diverse learning profiles of their students, ensuring that all students have the opportunity to reach their full potential. By incorporating a variety of instructional approaches, materials, and assessments, differentiated instruction fosters a personalized learning environment that engages students and promotes academic growth

Gamification, the integration of game-like elements into non-game contexts, has revolutionized the educational landscape, injecting excitement, motivation, and engagement into the learning process. Seaman (2017) underscores the power of gamification to enhance learner engagement, motivation, and achievement. By incorporating game-like elements such as points, badges, and leaderboards, gamification fosters a sense of competition, accomplishment, and reward, transforming learning into an enjoyable and stimulating experience

The convergence of peer assessment, differentiated instruction, and gamification presents a powerful synergy that can propel education toward the ideals of Education 5.0. Peer assessment, when embedded within a differentiated instructional framework, can provide students with personalized feedback tailored to their individual needs and learning styles.

Gamification, when integrated into peer assessment and differentiated instruction, can further enhance student engagement, motivation, and achievement. Faria et al. (2021) found that gamified peer assessment in a differentiated instructional setting led to increased student motivation, engagement, and academic performance. The combination of these pedagogical approaches creates a dynamic learning environment that aligns with the personalized, technology-driven, and lifelong learning principles of Education 5.0.

Based on the phenomena described above, this study will address the following two research questions:

1. To what extent does integrating peer assessment within a differentiated instructional framework utilizing gamification elements improve student learning outcomes in Education 5.0 settings?
2. How does the interaction of peer feedback, differentiated instruction, and gamification elements influence student engagement, motivation, and self-efficacy in Education 5.0 environments?

In addition, this systematic review is expected to be a reference for teachers, schools, and other education professionals to improve the quality of education in the future.

Methodology

Research Design

This study utilized Perry & Hammond's (2002) framework of systematic review. This systematic literature review employs a qualitative research methodology, specifically a thematic analysis approach. This choice aligns with the research objectives of exploring the multifaceted impact of integrating peer assessment and gamification within differentiated instruction (DI). Unlike quantitative research methods that focus on numerical data and statistical analysis, qualitative research delves into the "why" and "how" behind phenomena, making it ideal for understanding complex educational practices and their effects on student learning (Creswell, 2014). This methodology is particularly suited for exploring complex concepts and uncovering underlying meanings in a rich body of research (Nowell et al., 2017).

The final review consisted of 17 peer-reviewed articles that met the inclusion criteria and provided empirical data on the impact of peer assessment, DI, and gamification in Education 5.0 environments.

Data Collection

The primary data source for this review comprises peer-reviewed journal articles published between 2019 and 2024, focusing on the integration of peer assessment and gamification in differentiated instruction. The search will be conducted using reputable academic databases, including ScienceDirect, EBSCOhost, JSTOR, and ProQuest. These databases are selected for their comprehensive coverage of educational research and will ensure a thorough examination of current literature on the topic. Given their extensive indexing of peer-reviewed educational research and strong track record of providing access to high-quality academic content, ScienceDirect, EBSCOhost, JSTOR, and ProQuest were selected as the databases for this systematic review due to their comprehensive coverage in the subject of education, ensuring a broad and relevant range of literature addressing peer assessment, gamification, and DI. These databases also offer user-friendly interfaces and advanced search features that facilitate efficient literature retrieval and analysis. The keywords "peer assessment," "gamification," "differentiated instruction," and "Education 5.0" will guide the search process, aiming to identify studies, empirical research, and theoretical frameworks that explore the intersection of these pedagogical approaches. After identifying keywords, the next step is screening. Screening here is used to sort out articles in the database based on the criteria set, namely (i) according to the current research topic, (ii) published in 2019-2024, (iii) reputable international journal, and (iv) articles using English. After narrowing down the articles obtained from the database, it was finally determined that there were 17 articles that would be used as data sources.

Findings

A comprehensive search and analysis of relevant systemic reviews of research from 2019-2024 strengthens the case for integrating peer assessment, differentiated instruction, and gamification in Education 5.0 classrooms. While these strategies show promise in fostering engagement and 21st-century skills, further exploration is needed. Research on knowledge retention in different cultural contexts and effective teacher training methods will be crucial for maximizing their impact. The following key themes emerged:

Enhanced Student Engagement and Motivation

Peer assessment fostered a supportive learning environment where students felt valued and encouraged to share their knowledge and perspectives. It promotes a sense of community and helps students acquire lifelong skills in assessing and providing feedback to peers (Yundayani et al., 2024). Studies have shown that students demonstrate increased engagement, understanding, and willingness to provide and accept feedback (Ng & Yu, 2023) The back-and-forth nature of peer feedback, including feedback on peer feedback and the use of a wiki platform, contributes to these positive outcomes. Research by (Hsu et al., 2020b) also revealed that students in the experimental group, who utilized the peer assessment-based approach, generally performed better than those in the control group using the conventional mobile learning approach. Additionally, active learners in the experimental group exhibited higher intrinsic motivation, while active learners overall demonstrated higher extrinsic

motivation. The findings suggest that peer assessment activities may be particularly beneficial for active learners. This peer-to-peer interaction boosted student confidence, increased their belief in their abilities, and promoted a growth mindset.

Gamification further enhanced students' engagement and motivation by providing immediate feedback and rewards, reinforcing positive learning behaviors, and creating a sense of accomplishment. The use of gamification in educational contexts has been shown to increase student engagement and motivation (Almusharraf, 2023; H. L. Chen & Wu, 2023; Mazarakis & Bräuer, 2023; Titus & Ng'Ambi, 2023). The study by Mazarakis & Bräuer (2023) highlights the potential of using game design elements to boost engagement and participation in educational quizzes. The study found that all individual game design elements had a statistically significant impact on increasing motivation, with progress bars and badges being particularly effective in enhancing the number of questions answered. Combining game design elements resulted in even higher motivation and performance compared to the feedback-only condition. A study by Almusharraf (2023) revealed that Kahoot! notably improved student engagement, motivation, and classroom interaction compared to traditional teaching methods.

Improved Self-efficacy, Personalized Learning, and DI

Self-efficacy is a factor that should be taken into account in game-based learning. Self-efficacy is the conviction that one is naturally capable of accomplishing one's goals (Bandura 1982, 1994). Game-based learning approaches were more effective than traditional lecture methods in enhancing learning outcomes and self-efficacy (M. Wang & Zheng, 2021). However, there is a need to develop more educational games and professional development programs for teachers to effectively incorporate game-based learning into the classroom.

Differentiated education, which involves personalizing learning experiences to fit students' various needs and skills, can greatly boost self-efficacy by giving them particular chances to succeed and gain confidence in their abilities. For instance, a science game could be differentiated by offering various difficulty levels, allowing students to choose challenges that match their current understanding. The study by Sarzhanova et al. (2023) emphasizes the importance of integrating technology, pedagogy, and subject areas in teaching, highlighting that both pedagogical and technological competencies significantly influence self-efficacy toward differentiated instruction. Students who received DI-based instruction demonstrated higher scores in achievement, motivation, and autonomy than those who received traditional instruction (Sapan & Mede, 2022). Teachers can encourage students to explore their interests by enabling them to engage in independent study to pursue subjects they are passionate about (Magableh & Abdullah, 2020). As a result, the customized teaching approach improves individual performance, making it suitable for every learner (Grain et al., 2022). By integrating differentiated instruction into the classroom, educators can promote a more inclusive and effective learning environment that meets students' distinctive needs, leading to higher self-efficacy and improved educational outcomes.

Peer assessment and gamification, two innovative educational approaches, empower teachers to facilitate personalized learning by providing valuable insights into students' strengths, weaknesses, and learning styles. Through

peer assessment activities, teachers can identify individual needs and tailor instruction accordingly. For instance, after a group project, students can assess each other's contributions based on pre-defined criteria, allowing teachers to pinpoint areas where students might require additional support. Similarly, gamified learning environments can be designed with adaptive difficulty levels and incorporate different learning styles, catering to the diverse needs of students.

These strategies not only enhance student engagement and motivation but also lead to improved learning outcomes. By leveraging the data gathered through peer assessment and gamification platforms, teachers can provide immediate intervention and personalized support, ensuring every student receives the guidance they need to thrive. Moreover, this data can reveal common misconceptions or areas of difficulty within the class, enabling teachers to adjust their teaching strategies effectively.

Breaking away from the rigid, standardized approach, peer assessment and gamification acknowledge a dynamic, personalized learning experience that recognizes and addresses the unique strengths, challenges, and learning preferences of each student. By embracing these innovative teaching methods, educators can foster a more inclusive and stimulating learning environment where the student feels empowered to reach their full potential.

Enhanced Collaborative Learning and Critical Thinking

In Education 5.0, collaborative learning and critical thinking take center stage. This approach integrates technology, artificial intelligence, and human-centered learning to foster active participation, problem-solving skills, and higher-order thinking. Collaborative activities encourage students to engage in discussions, clarify concepts, and analyze diverse perspectives. This, in turn, strengthens their critical and creative thinking abilities. Research by Yundayani et al. (2024) demonstrates that Technology-Mediated Peer Assessment (TEMPA) improves learning outcomes, promotes self-regulation, self-reflection, and collaboration in English for Academic Purposes (EAP) courses. Students reported that TEMPA was a valuable tool for enhancing their learning experience. Additionally, studies like Sapan & Mede (2022) show that Differentiated Instruction (DI) fosters cooperation and engagement among students, leading to stronger peer bonds and positive interactions. By incorporating collaborative learning techniques, educators can create dynamic, student-centered environments that prepare students for the demands of the 21st century.

The shift towards Education 5.0 requires educators to adapt their teaching strategies to better engage students and prepare them for the challenges of the 21st century. One strategy receiving growing interest is the integration of gamification into classroom learning.

The study by Chen & Wu (2023) investigated the impact of a digital role-playing game on high school students' critical thinking skills and learning motivation. The results demonstrated significant improvements in specific critical thinking aspects, such as assumption identification and evaluation of arguments. However, no significant changes were observed in induction, deduction, and interpretation. This research emphasizes the potential of well-designed digital games to enhance critical thinking skills and learning motivation, suggesting that integrating such games into curricula and extending the study duration could yield further benefits. By incorporating digital games into classroom instruction, educators can create a more engaging and interactive learning environment that caters to a

variety of learning preferences and enhances students' critical thinking skills.

The success of gamification in the classroom depends heavily on the teacher's ability to design effective lessons that align with the learning material and student needs. For example, research by Chen & Yeh (2019) revealed that integrating student-generated questioning (SGQ) with game-based learning enhanced students' English performance. Interestingly, students perceived a higher cognitive load under the SGQ approach.

Academic Improvement and Psychological Changes in Students

Students' psychological development and their academic achievement are closely related since both enhance their overall well-being and success. A more positive learning environment can be created by psychological improvements including enhanced emotional control and resilience, while improved academic achievement can lead to increased confidence, motivation, and self-esteem. Differentiated Instruction is an effective teaching method for improving student achievement, motivation, and autonomy in English language learning (Magableh & Abdullah, 2020; Sapan & Mede, 2022). According to Shareefa (2021), Differentiated Instructions contributed positively to students' academic progress and psychosocial development. However, teachers also faced considerable obstacles, including a lack of competency, insufficient time due to high workloads, and difficulties in assessing student learning. Additionally, challenges such as limited resources, difficulty integrating subjects, and lack of parental awareness were identified. Despite these hurdles, teachers were able to implement DI satisfactorily, particularly in content and process differentiation, though product differentiation was less prevalent. In addition, the results of Grain et al. (2022) study showed that while differentiated instructions have a good effect on students' academic performance in English, students may feel anxious when studying scientific subjects. Understanding the connection between academic achievement and psychological changes can help educators create better strategies to help students develop and grow, resulting in improved academic performance and a more rewarding educational experience.

Education System 5.0

To align education with real-world needs, integrating theoretical concepts and practical knowledge is crucial. The first step towards this is enhancing research-based knowledge through experiments and innovation. Education 5.0 aims to emphasize practical reality by fostering human values and societal contributions, ultimately benefiting the nation. Educational institutions should address local industry, business, and societal issues, providing realistic solutions. The industry and society require educational institutions to offer exposure to real-time challenges, designing an educational system that addresses societal and national problems. In India, issues such as low employment rates, unbalanced courses, job creation, limited manufacturing, and fewer small-scale industries are prominent. Education 5.0 can help address these issues, aligning higher education with the nation's developmental needs. Curriculum planning, design, and promotion should focus on creating simple, realistic, and forward-looking curricula. Designing a well-planned curriculum requires input from all stakeholders, including parents, students, educators, industry professionals, and management. Education is a continuous process involving educational planning, curricular content, facilities, activities, teaching methodologies, assessment

practices, and evaluation results. This process requires rigorous brainstorming to identify the nation's needs and educational allocations, eliminating non-value-added processes. Universities, reformers, and policymakers should collaborate with communities to solve pertinent societal challenges (Nikum, 2022).

Building intellectual infrastructure requires developing new and innovative skill sets in both educators and students, supported by proper financing, training, and strategies. As the world moves towards digitalization, the educational field must adapt. Using technical and non-technical resources enhances experimental learning. Incorporating technologies such as data science (DS), artificial intelligence (AI), Internet of Things (IoT), machine learning (ML), cloud computing (CC), virtual reality (VR), and augmented reality (AR) should be encouraged. Continuous interactions among stakeholders, educators, and management are essential to support societal needs. Updating education with these technologies will transform teaching and learning methodologies, making learning more enjoyable. Educational institutes should foster an attitude of innovation, inquiry, and research among students, moving away from passive learning to active, research-driven education. This approach is essential for the 21st century and will prepare students to address real-world challenges effectively. Engaging in peer assessment encouraged students to critically evaluate their own work and the work of their peers. This process fostered higher-order thinking skills, such as analysis, synthesis, and evaluation. Gamification added an element of challenge and competition, motivating students to develop creative solutions and problem-solving strategies (Subandi et al., 2020).

Discussion

RQ 1: To what extent does integrating peer assessment within a differentiated instructional framework utilizing gamification elements improve student learning outcomes in Education 5.0 settings?

In the modern world of education, particularly within the Education 5.0 framework, integrating peer assessment along with elements of differentiated instruction (DI) and gamification provides a promising avenue to improve student learning outcomes. This approach leverages collaborative learning, personalized learning pathways, and motivational strategies to foster a dynamic and effective educational environment.

Peer assessment emerges as a powerful teaching strategy that promotes deeper learning and critical thinking skills among students. Research underscores its effectiveness in providing students with constructive feedback, encouraging self-reflection, and enhancing their ability to evaluate their own work and that of their peers (Topping, 2009). Studies have shown that students actively engaged in peer assessment (Hsu et al., 2020b) considered the feedback received and contemplated ways to further improve their work. Similarly, Ng & Yu (2023) found that students became more invested in improving their group reports after participating in interactive peer assessment, motivated by the desire to obtain higher marks from the lecturer. By actively involving students in assessing each other's work, peer assessment not only relieves teachers from the sole burden of evaluation but also encourages students to become active participants in their learning process.

Moreover, when integrated with differentiated instruction, peer assessment becomes even more beneficial. Differentiated instruction

acknowledges that students have different learning needs, abilities, and preferences. By tailoring instruction to accommodate these differences, educators can ensure that all students are appropriately challenged and supported. For instance, in multigrade classrooms, DI allows teachers to create tasks and assignments at varying levels of complexity, catering to both high-achieving students and those who may need additional support (Shareefa, 2021).

Gamification, another integral component of Education 5.0, adds an element of engagement and motivation. Research by Mazarakis & Bräuer (2023) demonstrates that combining gamification elements like progress bars, narratives, and badges with feedback resulted in even higher motivation and performance compared to the feedback-only condition. Digital games have the potential to enhance critical thinking skills and learning motivation (H. L. Chen & Wu, 2023). Integrating such games into curricula and extending the study duration could yield further benefits. Additionally, gamification can enhance students' learning outcomes in specific subjects, as shown in Wang's (2020) research where participants found the game provided authentic content and vocabulary, leading to improved communication skills.

In the realm of Education 5.0, the integration of peer assessment, gamification, and differentiated instruction (DI) revolutionizes the learning landscape, fostering a synergistic environment that nurtures engagement, personalization, and critical thinking skills among students. Peer assessment forms the cornerstone of this approach, promoting collaborative learning and self-evaluation as students actively assess each other's work, providing constructive feedback, and reflecting on their own performance. This process cultivates critical thinking, self-reflection, and collaborative learning, empowering students to become active participants in their learning journey.

Gamification further enhances the learning experience by introducing an element of fun and motivation. Game-like elements such as points, badges, and leaderboards captivate students' attention, fostering healthy competition and providing immediate feedback on their progress. This gamified approach not only increases engagement but also motivates students to strive for excellence and continuously improve their performance.

Differentiated instruction, another crucial component, recognizes the diverse learning needs, abilities, and preferences of students. By tailoring instruction to these individual differences, educators ensure that all students are appropriately challenged and supported. Varied learning activities, flexible grouping, and adaptive technology cater to diverse learning styles and abilities, providing personalized learning pathways and differentiated feedback.

The integration of these three elements – peer assessment, gamification, and differentiated instruction – creates a synergistic learning environment that optimizes student learning outcomes. Peer assessment promotes collaborative learning and self-evaluation, gamification adds engagement and motivation, and differentiated instruction tailors learning to individual needs. Together, these elements empower students as active participants in their learning, personalize learning pathways, and foster a dynamic and engaging learning environment. This transformative approach to education paves the way for students to reach their full potential and thrive in the ever-evolving world of Education 5.0.

RQ 2: How does the interaction of peer feedback, differentiated instruction, and gamification elements influence student engagement, motivation, and self-efficacy in Education 5.0 environments?

Society 5.0 and Education 5.0 are related to the formation of a digital technology-centered society in order to achieve a more inclusive, fairer, and sustainable world (Vieira, 2023). In Education 5.0 environments, the interaction of peer assessment, differentiated instruction, and gamification elements significantly impacts student engagement, motivation, and self-regulation. Peer feedback fosters a collaborative learning atmosphere where students actively participate in evaluating and improving each other's work. This process not only enhances their understanding of the subject matter but also cultivates essential communication and critical thinking skills. By receiving feedback from peers, students are motivated to refine their work, leading to increased engagement as they take ownership of their learning process. As Education 5.0 emphasizes integrating technology into the learning environment, utilizing peer assessment with technology is beneficial not only for teachers but also for students. Students found the use of Technology-Mediated Peer Assessment (TEMPA) improved their learning outcomes, facilitated self-regulation and self-reflection, provided motivational stimulation and collaboration, and was an effective tool for achieving learning objectives in the EAP (English for Academic Purposes) course. This kind of peer assessment was highly beneficial, as it captured their attention, met their personal needs, boosted their confidence, and provided satisfaction in the learning process. TEMPA was perceived as enhancing engagement, flexibility, and convenience in peer assessment activities (Yundayani et al., 2024).

Additionally, differentiated instruction (DI) plays a crucial role in addressing individual learning needs and preferences. It allows educators to tailor content, teaching methods, and assessment strategies to accommodate diverse student abilities and interests. DI is an effective teaching method for improving student achievement, motivation, and autonomy in English language learning. After being exposed to DI, students became more cooperative and engaged with their peers. They had stronger bonds and positive interactions with their peers (Sapan & Mede, 2022). DI also contributed positively to students' academic progress and psychosocial development. However, they also faced considerable obstacles, including a lack of competency, insufficient time due to high workloads, and difficulties in assessing student learning (Shareefa, 2020). In addition, the use of gamification in learning has been proven to be beneficial for increasing student engagement and motivation (Almusharraf, 2023; H. L. Chen & Wu, 2023; Mazarakis & Bräuer, 2023). Especially in the use of gamification for quiz like Kahoot! Student engagement levels were significantly higher in the sessions that used Kahoot! compared to the traditional sessions. Specifically, students' engagement levels were very high (86%) in the Kahoot! sessions, whereas in the traditional sessions, the instructor was mainly lecturing, and the students were mostly listening, resulting in a low overall engagement level (Almusharraf, 2023). The use of gamification coupled with the design of appropriate learning methods and materials can help to develop students' critical thinking, self-efficacy, and academic achievement. The synergy among peer feedback, differentiated instruction, and gamification in Education 5.0 environments promotes a holistic approach to student engagement,

motivation, and self-regulation. Peer feedback encourages collaborative learning and constructive peer interaction, fostering a supportive community of learners. Differentiated instruction ensures that educational content is accessible and challenging for all students, promoting personalized learning experiences that cater to individual needs. Gamification elements add an element of excitement and competitiveness, motivating students to actively participate and take responsibility for their learning outcomes. Overall, the integration of these three elements not only enhances academic achievement but also cultivates essential 21st-century skills such as collaboration, critical thinking, and self-directed learning.

Conclusion

In conclusion, the combined application of peer assessment, differentiated instruction, and gamification within Education 5.0 represents a revolutionary shift in fostering student learning. This multifaceted approach demonstrably yields positive outcomes, not only in terms of improved academic achievement but also in fostering essential skills for the 21st century.

Research consistently underscores the effectiveness of peer assessment in promoting critical thinking and collaborative learning. Studies reveal that students actively engaged in peer assessment not just provide valuable feedback to their peers, but also gain a deeper understanding of themselves through analyzing and evaluating others' work (Topping, 2009). This process transcends rote memorization, prompting students to critically analyze arguments, identify strengths and weaknesses, and articulate their own perspectives. Additionally, peer assessment fosters a more collaborative learning environment where students learn from and support each other, fostering a sense of shared responsibility for learning success.

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