Challenges in the Application of Digital Gamification Approaches in Teaching and Learning at Primary Schools

Khirubanraj Muruga, Khairul Azhar Jamaludin

Faculty of Education, University Kebangsaan Malaysia

ABSTRACT

Digital gamification has emerged as a dynamic and engaging approach in primary school teaching and learning, aiming to enhance student motivation, participation, and learning outcomes. Despite its growing relevance, the effective implementation of digital gamification in schools, particularly in rural and under-enrolled schools (SKM) faces numerous challenges. One major obstacle is the limited availability of digital infrastructure, including internet connectivity and devices, which hampers consistent access to gamified learning platforms. Additionally, many teachers exhibit low digital literacy and lack sufficient exposure to gamification strategies due to inadequate professional development opportunities. Time constraints and overloaded teaching schedules further hinder the design and execution of meaningful gamified lessons. On the students' end, issues such as unequal digital access, varying levels of motivation, and differing cognitive readiness present significant barriers to uniform engagement. Parents, especially in low-resource settings, often struggle with limited digital skills and are unable to provide consistent guidance or supervision at home. School administrators face scheduling rigidity and insufficient financial or technological support, while the government encounters challenges in establishing comprehensive standards and expanding infrastructure. To overcome these barriers, the study recommends enhancing digital access, conducting regular teacher training, introducing structured gamification modules, enabling flexible timetabling, and developing clear policy frameworks for sustainable integration.

Keywords: digital gamification, teaching and learning, primary school, challenges, improvement.

INTRODUCTION

In the 21st-century education era, the landscape of teaching and facilitation (T&L) has undergone significant transformation in line with technological advancements and the needs of the digital generation. Education today is no longer solely teacher-centered but has shifted toward a more interactive, dynamic, and learner-centered approach. According to Purnama (2018) Generation Alpha, those born between 2010 and 2024 are the main group in this digital education era. Exposed to technology from an early age, they rely heavily on information technology as a primary medium in daily life, including the learning process. In this context, the role of the teacher has evolved into that of a facilitator guiding students in exploring knowledge, encouraging critical thinking, fostering collaboration, and supporting creative problem-solving.

This paradigm shift has also led to the emergence of various innovative and integrated T&L approaches designed to meet the needs of a more active and visually inclined generation of learners. Among these approaches are project-based learning, student-centered learning, collaborative learning, inquiry-based learning, and gamification-based learning. All these methods require teachers to be more flexible, creative, and responsive in planning learning experiences that suit students' diverse learning styles. Moreover, technology-driven approaches have proven effective in enhancing student engagement and developing essential 21st-century learning skills such as higher-order thinking skills (HOTS), communication, collaboration, and creativity (Ambikapathy, Halili and Ramasamy, 2020).

Of these innovative approaches, gamification has attracted increasing attention among educators due to its strong potential to boost student interest and motivation in learning. Gamification refers to the integration of game elements such as challenges, rewards, leaderboards, point systems, and achievement levels into educational

contexts to make learning more enjoyable, meaningful, and student-centered (Chow, Fung and Ng, 2011). This approach fosters healthy competition among students, encourages cooperation, and builds self-confidence through small, continuous achievements. Indirectly, it transforms the learning environment from static to more active and engaging.

One of the key advantages of gamification is its ability to enhance student engagement and interaction during learning. In traditional learning environments, students often lose focus and become bored. However, by incorporating game elements into teaching and learning (T&L) sessions, students are more motivated to participate actively. Moreover, gamification provides teachers with the flexibility to tailor learning activities according to individual students' abilities and needs. A study by Groening and Binnewies (2019) found that gamification in education increases motivation and encourages positive social engagement. Through experience-based and interactive learning, students gain a deeper and more contextual understanding of concepts.

Nevertheless, the implementation of gamification is not without challenges. According to Ding, Er and Orey (2018) support for this approach among educators remains limited. In the context of primary schools, especially in under-enrolled schools (SKM) gamification offers an opportunity for more personalized and inclusive learning due to the smaller class sizes and closer teacher-student interactions. Teachers in SKM are well-positioned to design more targeted and effective gamified activities. However, barriers such as limited digital infrastructure, low teacher digital competency, and lack of professional training are major obstacles to the effective and widespread adoption of this approach.

Therefore, this concept paper aims to explore the key challenges in applying digital gamification in primary school teaching and learning, particularly in the context of today's education system which demands strategic shifts in pedagogical and technological adaptation. By understanding these challenges in depth, stakeholders in education can develop suitable intervention strategies to enhance the effectiveness of gamification as a future-focused T&L approach.

PROBLEM STATEMENT

Digital gamification is increasingly being adopted in primary school teaching and learning (T&L) as a strategy to boost student motivation and engagement (Chow, Fung and Ng, 2011). Game elements such as challenges, point systems, and rewards help make learning more enjoyable and effective. However, the implementation of digital gamification faces various challenges that undermine its effectiveness at the primary school level.

One of the main challenges is technological infrastructure limitations. Many primary schools, particularly those in rural areas and under-enrolled schools (SKM), still struggle with inadequate access to digital devices and unstable internet connections (Anamalai and Yatim, 2022). These shortcomings hinder teachers from consistently and effectively applying gamified approaches (Almeida et al., 2023).

In addition, teachers' competency in using gamification technology remains a significant barrier. A study by Tan Xiao Wei et al. (2022) found that many teachers lack specific training in digital gamification, resulting in low confidence and ineffective implementation. Teachers' heavy workload also limits the time available for planning gamified activities, which often require careful preparation (Tan, Melor and Nur Ehsan, 2022). From the students' perspective, while gamification can enhance short-term interest, poorly designed games may foster unhealthy competition and distract from learning (Ding, Er and Orey, 2018). Furthermore, the digital divide among students from varying socioeconomic backgrounds poses challenges to equitable access (Almeida et al., 2023). Therefore, this study aims to identify the key challenges in implementing digital gamification in primary schools in order to improve its effectiveness in the T&L process.

RESEARCH OBJECTIVES

The application of digital gamification in education is expanding in line with technological advancements and the pedagogical demands of the 21st century. However, its implementation still faces numerous challenges, including infrastructure limitations, low digital literacy among teachers, and insufficient professional training (Anamalai and Yatim, 2022). Therefore, the primary objective of this concept paper is to identify in detail the

issues and challenges faced by primary school teachers in applying digital gamification approaches in the teaching and learning process.

The second objective is to explore possible improvement strategies to overcome these challenges. These include recommendations such as enhancing teachers' technological pedagogical training, designing curricula that support gamification use, and developing user-friendly applications suited to the local context (Tan, Melor and Nur Ehsan, 2022). By achieving these two objectives, this concept paper aims to provide meaningful insights to strengthen the implementation of gamification at the primary level and serve as a guide for stakeholders in developing more comprehensive and sustainable policies and training programs.

LITERATURE REVIEW

4.1 Gamification

The term *gamification* is a loanword derived from the English word gamification (Rohaila and Fariza, 2017). This concept typically refers to an innovative approach that has gained increasing attention by incorporating the dynamic and mechanical elements of video games into non-game contexts. According to Deterding et al. (2011) the concept of gamification was first introduced in 2008. However, its adoption did not become widespread until the end of 2010 due to confusion surrounding related terms such as game layering, productivity games, reward systems, playful design, and behavior-based games.

4.2 Gamification In Education

The term gamification, originating from English, is now widely used as an approach that integrates dynamic and mechanical game elements into various fields, including education. In the educational context, gamification is defined as a game-based teaching and learning approach employed by teachers to encourage active student engagement in the learning process (Baah, Govender and Subramaniam, 2021).

Today's younger generation is more adaptable to changes across multiple domains, especially through innovative educational approaches. Therefore, the use of gamification in education is highly encouraged, as it provides opportunities for students to actively participate in learning at all academic levels. Gamification can influence student behavior in teaching and learning (T&L) and make the experience more engaging (Mat Husin, 2023). Moreover, it is considered an effective strategy to boost student motivation and involvement. Game elements such as badges and leaderboards are among the key attractions that capture students' interest (Khaleel, Zakaria and Ibrahim, 2016). Numerous studies conducted in Malaysia have shown that gamification has a positive impact on education.

The increasing use of smartphones and interactive technologies has made games more relevant and appealing as educational tools across various learning environments. As a result, gamification is widely used in schools to inspire and motivate students, thereby enhancing their active participation in the T&L process (Ismail and Mohamad Nasri, 2021). Furthermore, gamification helps stimulate and sustain goal-oriented and motivational behaviors across various aspects of life (Sailer et al., 2017). This approach can also encourage students to identify and develop their own talents and abilities.

There is growing evidence that gamification is increasingly accepted as an effective learning strategy for creating enjoyable and meaningful educational experiences. The success of digital games in education supports the effectiveness of gamification in boosting motivation, student participation, and social engagement through experiential learning (Groening and Binnewies, 2019). Additionally, gamification is seen as a valuable method for helping students acquire knowledge and improve essential skills such as communication, collaboration, and decision-making. It supports the development of 21st-century skills and creates a conducive environment for assessment, communication, and active teacher participation in the classroom. This approach also enhances creativity and fosters positive teacher-student relationships.

The rising interest in gamification has also prompted researchers and academics to explore its various dimensions in designing more engaging educational experiences and effective learning programs (Kyewski and Kramer,

2018). Although technological advancements have brought significant benefits to the T&L process, gamification-based pedagogy still faces several challenges. Key factors contributing to its ineffective implementation include the use of inappropriate game elements, weaknesses in instructional design, and technical issues. Other difficulties arise from classroom-related concerns and infrastructure limitations such as faulty computers, unstable internet connections, and power outages.

ISSUES AND CHALLENGES

5.1 Students

Although the digital gamification approach in education has the potential to enhance student engagement and make learning more enjoyable, its implementation in primary school settings is not without specific challenges faced by students themselves. Four main issues have been identified as barriers to the effective use of digital gamification among primary school pupils: the digital access gap, varying student preferences, immature cognitive development, and differing levels of motivation.

5.1.1 Digital Access Gap

A major challenge in implementing digital gamification is the disparity in access to digital devices and stable internet connections, particularly among students from low socioeconomic backgrounds or those living in rural areas. This digital divide results in unequal participation in gamified activities conducted online or through digital applications. A study by Anamalai and Yatim (2022) highlighted that some primary school students lack sufficient access to devices such as laptops or tablets, causing them to fall behind in learning experiences that are intended to be inclusive.

5.1.2 Varying Student Preferences

Each student has a unique learning style and set of interests. While gamification may capture the attention of students who enjoy competition or have an interest in games, not all students are drawn to such methods. Some learners prefer conventional or structured learning approaches and may feel uncomfortable with game elements that emphasize rewards and competition. This concern was also reflected in the study by Tan Xiao Wei, Melor Md Yunus, and Nur Ehsan Mohd Said (2022) which found that a number of students struggled to adapt to gamified approaches due to differing learning preferences.

5.1.3 Cognitive Maturity

Primary school students are at varying stages of cognitive development, and not all of them possess the metacognitive skills required for self-directed learning, strategic thinking, or complex problem-solving. Gamification that is too complex or mismatched with students' developmental levels may lead to confusion and stress, thereby reducing the effectiveness of learning. Almeida et al. (2023) also raised this concern, finding that game elements not tailored to students' cognitive abilities can lead to stress and boredom especially when students are unable to achieve the intended goals of the game.

5.1.4 Different Levels of Motivation

The varying levels of student motivation also present a significant challenge in the application of digital gamification. Some students are highly motivated by game-based learning due to its elements of rewards and challenges; however, others quickly lose interest if they do not achieve immediate success or fail to understand the game mechanics. Gamification that lacks personal meaning for students' risks becoming merely an entertainment activity without genuine learning outcomes. Groening and Binnewies (2019) explain that student motivation can be negatively affected when reward systems are unbalanced or do not have a significant impact on the student's long-term personal development.

5.2 teachers

The implementation of digital gamification approaches in primary school teaching and learning undoubtedly

offers great potential to increase student engagement and make learning more enjoyable and effective. However, the success of its implementation largely depends on the readiness and capability of teachers as the main facilitators of the strategy. Several key challenges faced by teachers in integrating digital gamification into teaching and learning include low technological proficiency, time constraints, insufficient professional development, and limited digital resources.

5.2.1 Low Technological Proficiency

One of the main challenges among teachers is their low level of digital literacy. Although many gamification applications and platforms are available, not all teachers are proficient or comfortable using these technologies in planning learning activities. This situation causes teachers to feel pressured and less confident in effectively integrating gamification elements. A study by Anamalai and Yatim (2022) found that many primary school teachers, especially in rural areas, lack proficiency in using interactive digital applications in teaching and learning, which ultimately hampers gamification implementation.

5.2.2 Time Constraints

Teachers also face time constraints in planning, developing, and implementing effective gamified learning activities. Designing effective gamification requires adequate time for content preparation and the creation of game elements such as rewards, challenges, and assessment mechanisms. In a teaching environment that demands numerous administrative and co-curricular tasks, teachers tend to prioritize conventional teaching methods that are easier and quicker to implement. According to Tan Xiao Wei, Melor Md Yunus, and Nur Ehsan Mohd Said (2022) many teachers stated that time constraints are a major barrier to exploring innovative teaching approaches like gamification, despite acknowledging its potential.

5.2.3 Professional Development Deficiencies

The lack of systematic and focused professional training also contributes to weak gamification implementation in classrooms. Although there are various professional development programs for teachers, most do not emphasize skills related to gamified instructional design. Teachers require continuous training that not only exposes them to gamification concepts but also provides practical opportunities to explore digital tools. According to Almeida et al. (2023) without strong training support, teachers tend to implement gamification superficially or merely imitate game elements without developing a solid pedagogical strategy.

5.2.4 Resource Limitations

The use of digital gamification also demands sufficient infrastructure and digital resources such as stable internet access, smart devices, and suitable educational applications. However, many schools especially rural primary schools and those with low enrolment face challenges related to physical facilities and financial constraints in supporting gamification implementation. Without adequate resource support, teachers must rely on limited existing materials or their own efforts to develop gamified content. In a study by Ahmad, Yunus and Hashim (2021) teachers expressed difficulties in obtaining licensed software or digital tools appropriate to their teaching content.

5.3 School Administrators

The role of school administrators is crucial in determining the direction and effectiveness of applying any pedagogical approach, including digital gamification, in teaching and learning (T&L) at the primary school level. Although gamification offers great potential to enhance student engagement and diversify learning methods, its implementation in schools often faces various administrative challenges. Key challenges faced by school administrators include limited resources and budget allocations, excessive focus on traditional academic assessments, and constraints related to scheduling of T&L sessions.

5.3.1 Limited Resources and Budget

School administrators frequently encounter challenges related to financial and infrastructural constraints that

hinder the comprehensive implementation of digital gamification. The development and maintenance of technology such as digital devices, stable internet connections, and subscriptions for gamification-based learning software involve high costs. This issue is more pronounced in rural primary schools or small schools with limited access to resources and budget allocations. A study by Anamalai and Yatim (2022) revealed that school administrators acknowledge financial factors as a major barrier to supporting sustainable digital initiatives, including the use of gamification approaches. Furthermore, the lack of support from stakeholders or external agencies contributes to this problem. Uneven technological infrastructure among schools creates disparities in the implementation of digital gamification. Without adequate funding and support, administrators struggle to provide appropriate facilities for teachers and students to effectively explore gamification pedagogy.

5.3.2 Focus on Academic Assessment

The second challenge is the current education system's emphasis on academic achievement through examination-based assessments, which often neglects student-centered approaches such as gamification. School administrators, pressured by academic performance demands and the measurement of student achievement through tests, tend to prioritize traditional teaching methods that align more closely with current assessment formats. This creates a dilemma for teachers who wish to implement gamification but do not receive full support from administrators focused on conventionally measurable academic results (Tan Xiao Wei, Melor Md Yunus and Nur Ehsan Mohd Said, 2022). Gamification focuses more on learning processes, collaboration, critical thinking, and active learning, which are difficult to measure through written assessments. Consequently, administrators often perceive this approach as incompatible with the school's primary objective of achieving academic success in examinations.

5.3.3 scheduling constraints

Limited teaching time and rigid scheduling structures also pose barriers to the widespread adoption of digital gamification. Gamification requires additional time for planning activities, preparing materials, and engaging students in interactive game-based activities, which may not be feasible within existing T&L periods. In a tightly packed and rigid timetable, it is difficult for administrators to provide flexible time slots for teachers to explore alternative pedagogical approaches like gamification. A study by Almeida et al. (2023) found that gamification implementation often stalls at the initial trial phase due to incompatibility with teaching schedules set by school administrators. Moreover, the absence of dedicated time slots for innovative activities makes it challenging for teachers to consistently and systematically apply gamification.

5.4 Parents

In today's digital era, digital gamification approaches are increasingly widespread in teaching and learning, including at the primary school level. Although this approach has the potential to boost student motivation and engagement, its implementation also faces various challenges from the perspective of parents. Parents play a critical role as the main supporters of student learning at home, but several factors hinder the effective implementation of digital gamification.

5.4.1 Economic Constraints

Economic constraints among parents are a major obstacle to the effective implementation of digital gamification at home. Digital devices such as computers, tablets, and smartphones that support gamified learning applications are often difficult for low-income families to afford. Additionally, the high cost and unstable internet access in rural areas further limit students' access to digital learning materials. A study by Abu Bakar et al. (2023) indicates that the digital divide is closely linked to socioeconomic background, where students from low-income families are less able to actively participate in digital learning.

5.4.2 Challenges of Monitoring and Guidance at Home

Gamification requires careful monitoring to ensure that students use technology wisely and effectively. However, parents who work full-time or have limited exposure to digital education face difficulties in guiding their children

at home. As a result, students tend to use gamification elements merely for entertainment without achieving the actual learning objectives. According to Anamalai and Yatim (2022) parents in rural areas expressed concerns about the lack of time and ability to monitor their children's use of technology in an educational context.

5.4.3 Digital Skills Gap Among Parents

Parents' level of digital literacy plays a crucial role in ensuring that gamification approaches can be well supported at home. Nevertheless, many parents are still not proficient in handling digital devices or understanding the functions of educational gamification applications. This deficiency affects communication between parents and teachers as well as parents' ability to track their children's learning progress through digital platforms. Tan Xiao Wei et al. (2022) emphasize that family support for digital learning heavily depends on parents' skills and understanding of educational technology.

5.4.4 Doubts About the Academic Effectiveness of Gamification

Some parents still hold conventional views on education and judge learning effectiveness solely based on exam achievements. Gamification, which is based on games, is often underestimated or seen as less serious. They worry that too many game elements could reduce children's focus on the actual learning content. The study by Almeida et al. (2023) shows that although gamification has great potential, negative perceptions from parents regarding the effectiveness of this pedagogy are among the main barriers to its widespread adoption.

5.5 Government

The government plays a vital role in strengthening the national education system, including introducing innovative approaches such as digital gamification in teaching and learning at primary schools. However, full implementation still faces various challenges requiring the attention of the authorities. Three main issues identified from the government's perspective are the absence of implementation standards for gamification, limitations in digital infrastructure, and the prioritization of summative assessments.

5.5.1 Absence of Gamification Implementation Standards

The lack of clear national guidelines or standards on digital gamification implementation leads to inconsistency in its use by teachers and schools. Although gamification is recognized as a pedagogical tool that can boost student motivation and engagement, its implementation remains unsystematic and dependent on individual teacher creativity (Anamalai and Yatim, 2022). Without official standards, it is difficult to comprehensively and consistently assess the effectiveness of gamification within the education system. Unstructured implementation can also lead to deviations from the actual learning objectives. Therefore, guidelines based on research and best practices must be developed to ensure gamification aligns with the national curriculum and meets the diverse Capabilities of Students.

5.5.2 Limitations of Digital Infrastructure

Despite government efforts such as the Malaysia Education Development Plan (PPPM) emphasizing the strengthening of technology use in education, many schools especially in rural areas still face significant challenges regarding digital infrastructure. Issues such as poor internet connectivity, insufficient devices, and lack of technology maintenance hinder optimal implementation of digital gamification. Research by Abu Bakar, Alias and Ahmad (2023) shows a significant digital divide between urban and rural areas, with rural schools often lacking access to modern gamification software and platforms. Delays in upgrading basic facilities also affect students' participation in gamification activities that require stable online access and digital interaction. If these infrastructure issues are not comprehensively addressed, gamification will remain an exclusive approach, inaccessible to all students.

5.5.3 Priority Given to Summative Assessment

Malaysia's education system still emphasizes exam-based assessment, where student success is measured by academic achievement in summative tests. This focus on traditional forms of assessment makes it difficult to

accept digital gamification as a legitimate method to support student learning. Gamification emphasizes experiential learning, self-achievement, and progressive improvement often incompatible with traditional assessment formats. According to Tan Xiao Wei, Melor Md Yunus, and Nur Ehsan Mohd Said (2022) policymakers express doubts about the effectiveness of unconventional approaches like gamification in strengthening academic achievement. Consequently, efforts to expand gamification use in teaching and learning are not prioritized in mainstream education policies. Hence, a paradigm shift towards formative assessments that support active pedagogies such as digital gamification is necessary.

IMPROVEMENT SUGGESTIONS

6.1 Students

To address the challenges faced by students in applying digital gamification, two main improvements are suggested: comprehensive digital access and inclusive, user-friendly game design. First, providing digital access should be a priority to ensure equal learning opportunities between urban and rural students. The existing digital divide significantly impacts student engagement in gamification-based learning activities. Therefore, efforts should focus on providing digital devices such as tablets or laptops, along with stable internet access, especially in remote areas (Tang et al., 2024). Schools, with support from the ministry and local communities, can establish digital access centers as alternative facilities for underprivileged students. This initiative aligns with the **SAMR model (Substitution, Augmentation, Modification, Redefinition)**, where digital access enables schools to progressively transform traditional learning tasks into gamified, technology-enhanced experiences.
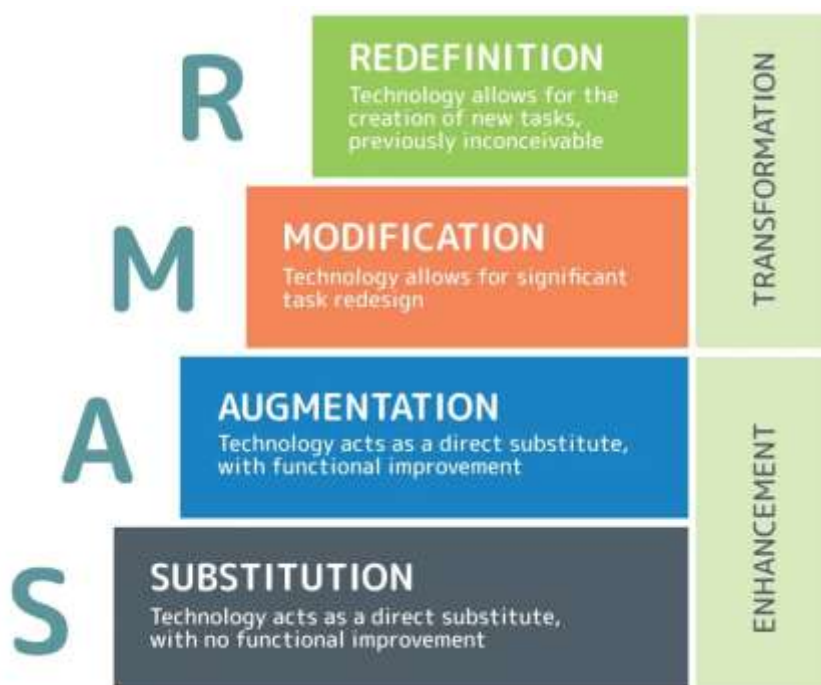

Figure 1 : SAMR MODEL

Second, the design of digital games needs to emphasize inclusivity. This means gamification content should consider differences in cognitive levels, interests, and backgrounds of students. Gamification that is too complex or biased towards one learning style may limit engagement of certain students. Hence, game elements should be designed with various levels of difficulty, immediate feedback, and motivational rewards to attract students of different abilities (Wan Zahid, 2024). Additionally, integrating collaborative elements helps build social skills and supports students who are less proficient individually.

6.2 Teachers

Regular professional training is a highly effective step to address challenges faced by teachers using digital gamification approaches in classrooms. Teachers need ongoing training that not only introduces gamification

concepts but also builds practical skills in using specific digital platforms such as Classcraft, Kahoot!, Quizizz, Wordwall and Edmodo Gamification Tools. For example, Classcraft allows teachers to gamify classroom management and learning tasks by assigning experience points, powers and collaborative quests, while platforms like Kahoot! and Quizizz enhance formative assessment through real-time gamified quizzes.
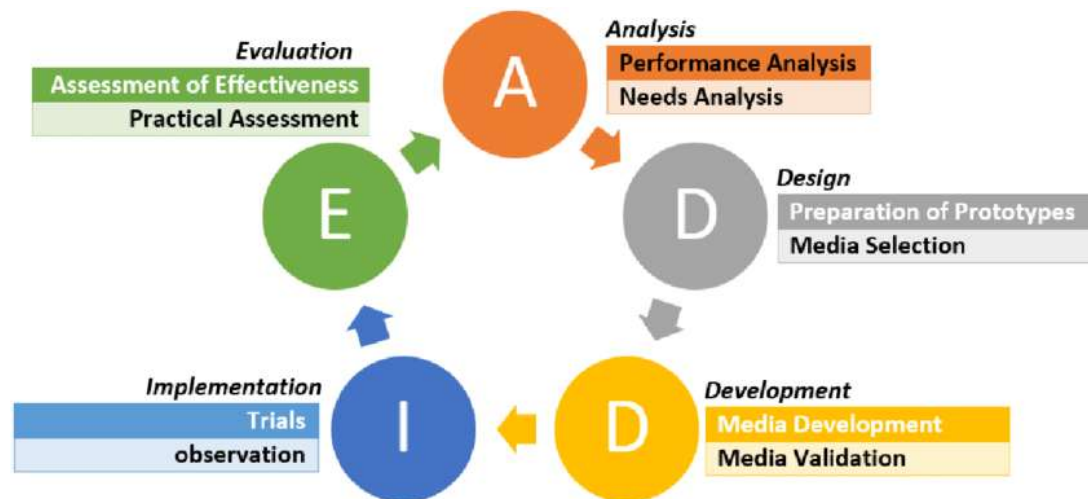

Figure 2 : ADDIE MODEL

A study by S. D. Klock et al. (2021) shows that structured training modules based on the ADDIE model positively impact teachers' professional competency in using digital gamification. Through such training, teachers can understand activity design, implementation and how to effectively evaluate student impact. Moreover, team support and reflective opportunities in interactive training foster a professional learning culture that supports pedagogical innovation.

Furthermore, emphasis should be placed on developing systematic gamification modules that provide clear step-by-step guidelines, sample activities and appropriate assessment elements. For instance, training modules could guide teachers in designing engaging quests and missions through platforms such as Classcraft or Minecraft Education Edition, as well as in creating effective point-based reward systems using tools like Edmodo or Google Classroom add-ons. In addition, teachers can be trained to conduct gamified quizzes and competitions via Kahoot!, Quizizz or Wordwall, which foster active participation and motivation among students. Another valuable component is the use of collaborative digital escape rooms through Breakout EDU, which not only makes learning fun but also encourages teamwork and problem-solving skills. By integrating these elements, systematic modules can better equip teachers with practical strategies to implement gamification effectively in classrooms.

These modules should integrate key aspects such as objectives, types of rewards, immediate feedback, and collaborative systems among teachers (S. D. Klock et al., 2021). With such modules, teachers do not need to start designing from scratch but can adapt modular resources according to curriculum content and student ability levels. The effectiveness of these modules is enhanced through experience-sharing activities among teachers. For instance, Klock et al. (2022) demonstrated that gamification not only increased student engagement but also improved peer observation, pedagogical discussions and professional collaboration among teachers. Such models improve implementation quality and ensure sustainable gamification strategies.

6.3 School Administrators

In facing the challenges of applying digital gamification approaches in teaching and learning at primary schools, the role of school administrators is critical in ensuring effective implementation. Two main suggestions to enhance the success of digital gamification are the provision of resources and infrastructure, and the arrangement of more flexible scheduling.

First, school administrators must ensure adequate provision of digital resources and infrastructure to support

gamification implementation in teaching and learning. A study by Wulan et al. (2024) shows that lack of technology infrastructure, such as unstable internet access and insufficient digital devices, is a major barrier to gamification application in primary schools. Therefore, administrators should strive to obtain allocations from educational authorities to improve technological facilities in schools. Collaboration with private sectors and local communities can also be established to enhance existing digital infrastructure.

Second, flexible scheduling is important to give teachers room to carry out gamification activities without disrupting other subject teachings. According to Wulan et al. (2024) tight and inflexible schedules make it difficult for teachers to integrate gamification elements into their teaching. Hence, administrators need to consider timetable adjustments to provide space for gamification activities. This includes setting aside dedicated time for interactive activities and giving teachers the freedom to plan activities that align with learning objectives.

6.4 Parents

To address the challenges faced by parents in the application of digital gamification approaches in teaching and learning (T&L) at primary schools, several improvement suggestions need attention. First, implementing awareness programs for parents is crucial to enhance their understanding of the benefits and methods of using digital gamification in their children's learning. These programs can take the form of workshops, seminars, or virtual communication sessions that expose parents to the concept of gamification, how it is applied in T&L, and its impact on students' academic achievement and motivation. According to Suh, Wagner, and Liu (2021) high parental involvement in children's digital learning can improve the effectiveness of educational technology use, thereby supporting better learning outcomes. Furthermore, increased parental awareness can reduce doubts about the effectiveness of gamification and increase their support in the home learning process.

Second, providing easily accessible and user-friendly learning resources at home is an important step to help parents guide their children in using digital gamification approaches. These resources can include simple guides, tutorial videos, or support applications specifically designed so parents can understand and effectively use learning materials. The study by Anamalai and Yatim (2022) emphasizes that providing appropriate home learning resources can reduce the digital skills gap between students and parents, thereby facilitating monitoring and guidance of learning. This contributes to increased student motivation and achievement while building close collaboration between school and family to ensure successful gamification implementation.

6.5 Government

The implementation of digital gamification approaches in teaching and learning at primary schools requires strong support from the government, particularly in policy development and investment in digital infrastructure.

First, the government should provide clear policies and guidelines regarding the implementation of gamification in education. According to Sailer et al. (2021) clear policies can guide schools and teachers in effectively integrating gamification elements in T&L, ensuring the approach meets national education standards and learning objectives. These policies should also cover student data security and privacy aspects in the use of digital gamification applications (García-Sánchez et al., 2022).

Second, continuous investment in digital infrastructure is essential to overcome limitations in access and technological support in primary schools, especially in rural areas. For example, the study by Anamalai and Yatim (2022) highlights that lack of internet access and sufficient devices is a major barrier to gamification use in T&L. Therefore, the government needs to expand high-speed internet access and provide digital devices to schools in need. This investment should be accompanied by technical training for administrators and teachers to ensure effective technology use in classrooms.

CONCLUSION

In conclusion, the application of digital gamification approaches in teaching and learning at primary schools faces various complex challenges requiring comprehensive attention from all stakeholders.

From the students' perspective, issues such as the digital access gap, differences in learning preferences, varying cognitive maturity levels, and uneven motivation negatively impact the effectiveness of gamification in enhancing student engagement and academic achievement. For teachers, low technology proficiency, time constraints, lack of professional training, and limited resources are the main obstacles to effective implementation of this approach. School administrators face challenges such as limited resource allocations, prioritization of traditional academic assessments, and tight schedules restricting gamification implementation opportunities.

Moreover, parents encounter challenges including economic constraints, digital skills gaps, difficulties monitoring children's learning at home, and doubts about the effectiveness of digital gamification. Meanwhile, the government struggles with the absence of standardized gamification implementation, limited digital infrastructure, and excessive emphasis on summative assessments that restrict pedagogical innovation.

Therefore, holistic implementation of improvement suggestions including provision of digital access, regular teacher training, sufficient resource allocation, and clear policy and guideline development is essential to ensure effective and sustainable application of digital gamification in teaching and learning at primary schools.

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