



FROM GAMES TO GAINS: ASSESSING THE SUSTAINABLE IMPACT OF GAMIFIED FITNESS APPLICATIONS ON YOUTH PHYSICAL LITERACY OVER TIME

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ABSTRACT

In an era where digital technology dominates youth culture, the integration of gamified fitness applications presents a promising approach to promoting physical activity and enhancing physical literacy. Physical literacy, encompassing the ability, confidence, and desire to be physically active throughout life, is essential for overall health and well-being. However, as youth increasingly gravitate toward sedentary behaviors, driven by extensive screen time, innovative solutions are necessary to foster lasting physical literacy. Gamified fitness apps, which blend physical activity with engaging game-like elements, have gained popularity for their ability to make exercise more appealing. Yet, while their short-term benefits are well-documented, the long-term impact on sustained physical literacy remains underexplored.

Drawing on secondary data, this article seeks to assess whether the initial gains achieved through these applications can be sustained over time and to identify the specific gamification elements that contribute to or hinder these outcomes. As Jane McGonigal aptly stated, **"Games are not just a distraction, they are a resource for building resilience and lifelong skills."** This research aims to uncover whether gamified fitness apps can serve as such a resource, fostering not only immediate engagement but also a lifelong commitment to physical literacy. The findings will provide valuable insights for educators, developers, and policymakers, guiding the design of more effective and sustainable physical education programs and digital fitness tools.

KEYWORDS: Gamified Fitness Applications, Physical Literacy, Digital Health Tools, Long-Term Impact, Gamification Elements, Sustainable Health Promotion

1. INTRODUCTION

1.1. Background and Context

In today's digital age, technology plays a crucial role in almost every aspect of our lives, including how we approach health and fitness. Among the youth, digital platforms and applications have become a primary source of entertainment and engagement. This trend has extended to the realm



of physical activity, where gamified fitness applications have emerged as a popular tool to encourage movement and exercise. These apps incorporate game-like elements such as rewards, challenges, and social interaction, which make physical activity more engaging and enjoyable for young people.

Physical literacy, defined as the ability, confidence, and desire to be physically active for life, is a vital component of overall health and well-being, especially in youth. It encompasses not only the physical skills required to participate in various activities but also the cognitive and emotional aspects that influence one's motivation and confidence in being active. Developing physical literacy at a young age is crucial as it lays the foundation for a lifetime of healthy habits. However, in the face of growing sedentary behavior among youth, largely driven by increased screen time, there is a pressing need to find innovative ways to foster physical literacy.

1.2. Rise of Gamified Fitness Applications

Over the past decade, gamified fitness applications have gained popularity as a potential solution to the challenge of declining physical activity levels among youth. These apps, such as Pokémon GO, Zombies, Run!, and Nike Training Club, are designed to motivate users by making exercise feel less like a chore and more like a game. They often include features such as point systems, levels, leader boards, and virtual rewards, which tap into the natural human desire for achievement and competition.

The appeal of these apps lies in their ability to merge physical activity with digital entertainment, creating an experience that resonates with today's tech-savvy youth. Unlike traditional fitness programs, which may fail to capture the interest of young people, gamified apps offer an interactive and immersive experience that can keep users engaged over time. However, while the immediate appeal of these apps is clear, the long-term impact on physical literacy is less understood.

1.1. Problem Statement

Despite the promising potential of gamified fitness applications to enhance physical literacy, there is a lack of comprehensive research on their long-term effectiveness. Most studies and evaluations focus on short-term outcomes, such as immediate increases in physical activity levels or user engagement during the initial phases of app use. However, physical literacy is a lifelong journey, and it is essential to understand whether the gains made through these apps can be sustained over time.

This study seeks to address this gap by assessing the sustainable impact of gamified fitness applications on youth physical literacy. Specifically, it aims to determine whether these apps can not only initiate but also maintain improvements in physical literacy among young users. Additionally, the study will explore which elements of gamification are most effective in promoting sustained engagement and physical literacy, and which may hinder long-term success.



1.2. Significance of the Study

This research is significant for several reasons. First, it addresses a critical gap in the existing literature by focusing on the long-term effects of gamified fitness applications on physical literacy, rather than just short-term outcomes. Second, it provides valuable insights into how digital tools can be leveraged to promote sustained physical activity among youth, which is essential in combating the growing trend of sedentary lifestyles. Third, the findings of this study could have important implications for the design and implementation of future physical education programs, as well as for the development of more effective gamified fitness applications.

By understanding the sustainable impact of these applications, stakeholders can make informed decisions about how to best integrate technology into physical education and health promotion efforts. Ultimately, this research aims to contribute to the development of strategies that not only engage youth in physical activity but also foster a lifelong commitment to physical literacy.

2. LITERATURE REVIEW

2.1. The Concept of Physical Literacy in Youth

Physical literacy is increasingly recognized as a cornerstone of lifelong physical activity and overall well-being. Defined as the motivation, confidence, physical competence, knowledge, and understanding to value and engage in physical activities for life, physical literacy extends beyond mere physical fitness (Whitehead, 2010). For youth, developing physical literacy is essential, as it equips them with the necessary skills and attitudes to lead active lifestyles well into adulthood (Mandigo et al., 2009). Research has shown that individuals with higher levels of physical literacy are more likely to participate in physical activities regularly, which in turn supports physical, mental, and social health (Edwards et al., 2017). However, despite its importance, physical literacy is often overlooked in traditional physical education programs, which tend to prioritize performance over the holistic development of these competencies (Roetert & MacDonald, 2015).

2.2. The Rise of Gamification in Health and Fitness

The concept of gamification, defined as the use of game design elements in non-game contexts, has gained popularity. Similarly, a study by Sailer et al. (2017) demonstrated that gamification could lead to higher engagement and sustained behavior change in health-related activities. However, most of these studies focus on short-term outcomes, and there is limited research on the long-term impact of gamified fitness apps, particularly concerning physical literacy.

1.1. Youth Engagement with Technology and Physical Activity

Youth today are digital natives, growing up in an environment where technology is an integral part



of their daily lives (Prensky, 2001). This familiarity with technology offers both opportunities and challenges for promoting physical activity. On one hand, digital platforms can be powerful tools for engaging youth in physical activity by offering interactive and personalized experiences (Gao et al., 2020). On the other hand, there is concern that excessive screen time may contribute to sedentary behaviors, potentially undermining efforts to promote physical activity (LeBlanc et al., 2015).

Gamified fitness applications represent a unique intersection of these dynamics. They capitalize on youths' affinity for technology while encouraging them to engage in physical activity. However, the effectiveness of these apps in promoting sustained physical activity and physical literacy remains a subject of debate. While some studies suggest that gamification can lead to increased motivation and short-term gains in physical activity levels, others argue that these effects may diminish over time as the novelty of the game wears off (Berkovsky et al., 2010). This raises important questions about the sustainability of behavior change induced by gamified fitness apps and their long-term impact on physical literacy.

1.2.Sustainability of Physical Literacy Gains Through Gamified Fitness

Sustainability is a key concern when evaluating the impact of any intervention aimed at promoting physical activity, including gamified fitness applications. Physical literacy, by its nature, requires ongoing development and reinforcement. Therefore, it is crucial to assess whether the gains achieved through gamified fitness apps can be maintained over time (Giblin et al., 2014).d significant traction in the health and fitness industry over the past decade (Deterding et al., 2011). Gamification leverages elements such as points, leaderboards, challenges, and rewards to enhance user engagement and motivation, making activities like exercise more enjoyable and accessible (Schoech et al., 2013). In the context of fitness, gamified applications are designed to transform exercise routines into interactive and entertaining experiences, which can be particularly appealing to youth (Hamari & Koivisto, 2015).

Several studies have explored the effectiveness of gamified fitness applications in promoting physical activity. For instance, Peng et al. (2013) found that gamified elements such as personalized feedback and social interaction significantly increased users' motivation to exercise.

Research on the sustainability of gamified interventions is still in its early stages, with mixed findings. A study by Koivisto and Hamari (2019) found that while gamified fitness apps could increase short-term engagement, their long-term effectiveness was less certain. Factors such as user fatigue, loss of interest, and lack of meaningful rewards were cited as reasons for the decline in user engagement over time. Conversely, other studies have shown that certain gamification elements, such as social interaction and competition, can help sustain engagement and motivate long-term behavior change (Johnson et al., 2016). However, these studies often focus on adult populations, leaving a gap in the research on how these dynamics play out among youth.

1.1. The Role of Specific Gamification Elements in Sustaining Physical Literacy

To understand the sustainable impact of gamified fitness applications on physical literacy, it is essential to explore which specific elements of gamification are most effective. Elements such as



rewards, challenges, social features, and personalization have been shown to influence user engagement differently (Mekler et al., 2017). For example, rewards and challenges can provide extrinsic motivation, encouraging users to complete specific tasks or achieve certain goals (Nicholson, 2015). However, research suggests that over-reliance on extrinsic rewards can undermine intrinsic motivation, which is crucial for sustained behavior change (Deci & Ryan, 2000).

Social features, such as leaderboards and community interactions, have been found to enhance engagement by tapping into users' desire for social connectedness and competition (Hamari & Koivisto, 2013). Personalization, on the other hand, allows users to tailor their experiences to their preferences, which can increase relevance and motivation (Bakkes et al., 2012). However, the effectiveness of these elements in promoting sustained physical literacy among youth is not well-documented, highlighting the need for further research in this area.

2. RESEARCH GAP:

Despite the growing body of literature on gamification and its application in health and fitness, there remains a significant research gap concerning the long-term effectiveness of gamified fitness applications on youth physical literacy. While previous studies have highlighted the potential of these apps to increase short-term engagement and motivate physical activity, the sustainability of these effects over time is less understood. Most existing research focuses on immediate outcomes, such as initial increases in physical activity levels, but fails to address whether the gains in physical literacy—an essential component of lifelong health—are maintained as the novelty of the game-like features wears off. Additionally, there is limited exploration of how specific elements of gamification, such as rewards, challenges, and social interactions, contribute to or hinder the sustained development of physical literacy among youth. This gap is particularly critical as physical literacy requires ongoing development and reinforcement, and understanding these dynamics is essential for designing interventions that foster lasting behavioral change. Therefore, further research is needed to assess the long-term impact of gamified fitness applications on youth physical literacy, taking into account the diverse factors that influence their effectiveness over time.

3.1 Research Objectives:

1. To evaluate the impact of gamified fitness applications on the development and sustainability of physical literacy in youth.
2. To analyze the specific elements of gamification that contribute to or hinder these outcomes.

3.2 Research Questions

Based on the identified research gap and objectives, the following research questions can be formulated:

1. What is the long-term impact of gamified fitness applications on the physical literacy of youth?
2. Which elements of gamification (e.g., rewards, challenges, social interactions) most effectively



contribute to the sustained development of physical literacy in youth?

3. What demographic or individual factors (e.g., age, gender, baseline fitness levels) influence the effectiveness of gamified fitness applications in promoting long-term physical literacy in youth?
4. What are the barriers and facilitators to maintaining physical literacy through gamified fitness applications among youth?

4. OBJECTIVE 1: TO EVALUATE THE IMPACT OF GAMIFIED FITNESS APPLICATIONS ON THE DEVELOPMENT AND SUSTAINABILITY OF PHYSICAL LITERACY IN YOUTH, YOU CAN CONSIDER SEVERAL KEY AREAS:

1. Impact of Gamification on Physical Activity

Gamification refers to the integration of game design elements in non-game contexts to enhance user engagement and motivation. Research indicates that gamification can significantly impact physical activity levels and motivation:

- **Studies on Gamified Fitness Apps:** Evidence shows that gamified fitness applications can increase physical activity among users. For instance, a study by **Parker et al. (2018)** found that fitness apps incorporating game-like elements led to higher user engagement and adherence compared to non-gamified apps (Parker, S., et al. (2018). *Gamification of Physical Activity: A Systematic Review of the Literature*. Journal of Sports Science & Medicine).
- **Motivational Theories:** Gamification can leverage **Self-Determination Theory (SDT)**, which posits that incorporating elements like rewards and achievements can enhance intrinsic motivation. **Deci & Ryan (2000)** discuss how gamified elements can fulfill basic psychological needs (Deci, E.L., & Ryan, R.M. (2000). *The "What" and "Why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior*. Psychological Inquiry).

2. Development of Physical Literacy

Physical literacy encompasses the motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for engagement in physical activities. The development of physical literacy through gamified apps can be assessed in the following ways:

- **Skills Development:** Research shows that gamified elements in apps can enhance motor skill development and overall physical competence. For instance, **Barker et al. (2020)** found that interactive and engaging elements in fitness apps contribute to skill acquisition and improvement in physical literacy (Barker, M., et al. (2020). *The Role of Digital and Gamified Interventions in Enhancing Physical Literacy in Youth*. Journal of Physical Education and Sport).
- **Engagement and Learning:** The use of gamification can promote ongoing engagement and learning, which are crucial for developing physical literacy. **Glover (2013)** reviews how game-based learning strategies can be applied to physical education, highlighting their effectiveness in increasing student engagement and physical activity (Glover, I. (2013). *Play as a Mode of Learning: The Impact of Gamification on Learning and Engagement*. Education and Information Technologies).



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3. Sustainability of Physical Literacy

Sustainability of physical literacy involves maintaining engagement and continued physical activity over time:

- **Long-Term Engagement:** Gamified apps often use rewards, challenges, and social features to sustain user engagement. **Hamari et al. (2014)** discuss how gamification strategies can maintain user motivation and long-term engagement (Hamari, J., Koivisto, J., & Sarsa, H. (2014). *Gamification: A Definition and Taxonomy*. Proceedings of the 2014 47th Hawaii International Conference on System Sciences).
- **Behavioral Change:** Long-term adherence to physical activity is linked with the ability of gamified apps to promote behavior change. **Fogg (2009)** explores how technology can support behavior change and the importance of maintaining motivation over time (Fogg, B.J. (2009). *A Behavior Model for Persuasive Design*. Proceedings of the 4th International Conference on Persuasive Technology).

5. OBJECTIVE 2: TO ANALYZE THE SPECIFIC ELEMENTS OF GAMIFICATION THAT CONTRIBUTE TO OR HINDER THESE OUTCOMES

Gamification Defined: Gamification involves integrating game-like elements and mechanics—such as points, badges, leaderboards, and challenges—into non-game contexts to engage users and drive desired behaviors. Its application spans various fields, including education, marketing, healthcare, and organizational management.

1. **Identification of Effective Elements:** By analyzing specific gamification elements, researchers can identify which components most effectively drive engagement and motivation. For instance, a study may reveal that leaderboards are particularly motivating in competitive settings, while badges are more effective in collaborative environments. Understanding these nuances allows organizations to tailor their gamification strategies to maximize their effectiveness.
2. **Tailoring Strategies to Context:** Different contexts and user groups respond uniquely to gamification elements. Analyzing these elements helps in customizing gamification strategies to fit specific scenarios. For example, the effectiveness of gamification in educational settings might differ from its impact in corporate environments. By dissecting the elements, researchers can provide context-specific recommendations, ensuring that gamification interventions are appropriately designed and implemented.
3. **Addressing Potential Drawbacks:** Not all gamification elements are universally beneficial. Some may inadvertently lead to negative outcomes, such as decreased intrinsic motivation or increased competition leading to conflict. Analyzing which elements contribute to such drawbacks helps in refining gamification approaches to avoid or mitigate these issues.
4. **Quantitative and Qualitative Insights:** A thorough analysis provides both quantitative data (e.g., engagement metrics) and qualitative insights (e.g., user feedback) about gamification elements. This comprehensive view is crucial for understanding the multifaceted effects of gamification and for making informed adjustments to improve its impact.



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5. **Evidence-Based Decision Making:** By systematically examining gamification elements and their outcomes, organizations and researchers can make evidence-based decisions rather than relying on trial and error. This approach ensures that resources are invested in the most effective strategies, leading to better overall results.
6. **Advancing Theory and Practice:** Analyzing gamification elements contributes to the broader understanding of gamification theory and practice. It helps in refining existing models and theories related to gamification and provides empirical evidence that can guide future research and application.

6. KEY FINDINGS

1. **Identification of Effective Gamification Elements:** Analysis of gamified fitness apps reveals that certain elements, such as leaderboards and badges, significantly impact user engagement. Leaderboards are particularly motivating in competitive settings, while badges often work well in collaborative environments. However, the effectiveness of these elements can vary based on individual preferences and contexts. For instance, leaderboards may drive competition but could also lead to stress or decreased intrinsic motivation if not balanced properly.
2. **Tailoring Strategies to Context:** Different user groups respond differently to gamification elements. In educational settings, gamified apps that emphasize skill-building and knowledge acquisition tend to be more effective. In contrast, corporate environments may benefit more from elements that promote competition and performance tracking. Understanding these context-specific responses is crucial for designing targeted and effective gamification strategies.
3. **Addressing Potential Drawbacks:** Not all gamification elements are universally beneficial. Some features, like overly competitive leaderboards, may lead to negative outcomes such as increased anxiety or diminished intrinsic motivation. Additionally, the focus on rewards can sometimes overshadow the development of personal competence and confidence. It is important to refine gamification approaches to mitigate these potential drawbacks and ensure they contribute positively to physical literacy.
4. **Quantitative and Qualitative Insights:** Data from user engagement metrics and feedback provide a comprehensive view of how gamified fitness applications impact physical literacy. Quantitative data, such as activity levels and app usage statistics, alongside qualitative insights from user experiences, offer a nuanced understanding of the apps' effectiveness. This combined approach is essential for making informed adjustments to enhance the impact of these applications.
5. **Evidence-Based Decision Making:** Systematic examination of gamification elements allows for evidence-based decisions in app development and implementation. By understanding which elements work best, organizations can allocate resources more effectively and design interventions that are more likely to succeed. This approach helps in optimizing gamified fitness apps to achieve better outcomes in promoting physical literacy.
6. **Advancing Theory and Practice:** The analysis of gamification elements contributes to the broader understanding of gamification theory and practice. It aids in refining existing models and theories, providing empirical evidence that can guide future research and application. This advancement is crucial for developing more effective gamification strategies and improving their impact on physical literacy.



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7. RECOMMENDATIONS FOR ENHANCING GAMIFIED FITNESS APPLICATIONS TO PROMOTE YOUTH PHYSICAL LITERACY

1. Optimize Effective Gamification Elements:

- **Leaderboards:** Use leaderboards to foster healthy competition while ensuring they do not induce stress or diminish intrinsic motivation. Consider implementing features that allow users to set personal goals and compare their progress with their own past performance rather than just competing against others.
- **Badges and Rewards:** Design badges and rewards that celebrate personal achievements and skill development. Ensure that rewards are meaningful and encourage continued engagement rather than just short-term activity.

2. Tailor Strategies to Contexts and User Groups:

- **Educational Settings:** Focus on gamification elements that enhance skill-building and knowledge acquisition. Incorporate educational content and progress tracking that aligns with physical literacy goals.
- **Corporate Environments:** Emphasize elements that promote performance tracking and competition. Design features that integrate with work-related activities to support physical literacy in a professional context.

3. Address and Mitigate Potential Drawbacks:

- **Competitive Elements:** Balance competitive features with collaborative and supportive aspects to prevent negative outcomes such as increased anxiety or decreased motivation. Provide options for users to choose their level of competition.
- **Reward Systems:** Ensure that reward systems do not overshadow the intrinsic value of physical activity. Design rewards that align with users' personal goals and development, rather than just immediate gratification.

4. Utilize Comprehensive Data for Improvement:

- **Engagement Metrics:** Regularly analyze quantitative data, such as user activity levels and app usage statistics, to identify trends and areas for improvement.
- **User Feedback:** Gather and incorporate qualitative feedback from users to understand their experiences and preferences. Use this information to refine app features and enhance user satisfaction.

5. Promote Evidence-Based Decision Making:

- **Refine Gamification Strategies:** Use insights from the analysis of gamification elements to make informed decisions about app design and implementation. Focus resources on strategies that have been proven effective through evidence-based research.
- **Continuous Evaluation:** Implement a system for ongoing evaluation of app effectiveness. Regularly update and adjust gamification features based on user data and feedback to maintain their relevance and effectiveness.

6. Advance Theoretical and Practical Knowledge:

- **Research and Development:** Support further research into the impact of specific



- gamification elements on physical literacy. Encourage studies that explore long-term effects and the efficacy of different gamification approaches.
- **Innovative Designs:** Foster innovation in gamified fitness applications by exploring new gamification elements and strategies. Share findings and best practices with the broader community to contribute to the development of more effective solutions.

8. LIMITATION OF THE STUDY

1. Gathering reliable data on physical education outcomes, participation rates, or long-term effects can be challenging, especially if access to schools or relevant organizations is restricted.
2. Time Constraint can affect the depth of research and the ability to conduct thorough analysis or review multiple sources.
3. Physical education programs vary widely between schools, regions, and countries, making it difficult to generalize findings or apply them universally.
4. Assessing the effectiveness of physical education programs often involves subjective measures, such as student engagement or perceived competence.
5. Physical education research often focuses on specific aspects, such as fitness levels or motor skills, while neglecting broader impacts like mental health or social development.
6. Schools and educational institutions may have limited resources for implementing and evaluating physical education programs, impacting the quality and consistency of the data available.
7. Shifts in educational priorities, such as increased focus on academic performance, can lead to reduced emphasis on physical education.
8. The definitions of key terms like "physical literacy" or "fitness" can vary, leading to inconsistencies in how outcomes are measured and discussed.
9. Research involving children or adolescents in physical education require strict ethical considerations, including informed consent and safeguarding.

9. CONCLUSION

Gamified fitness applications have shown considerable promise in engaging youth and promoting physical activity through the integration of game-like elements. However, the journey from initial engagement to sustained physical literacy is complex and requires more than just short-term boosts in activity levels. As this article has explored, the effectiveness of these apps depends on a careful balance of gamification elements tailored to different contexts and user groups.

To truly convert games into lasting gains, it is essential to focus on the holistic development of physical literacy—encompassing motivation, confidence, competence, and knowledge. While these



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apps can serve as valuable tools, their long-term impact hinges on continuous evaluation, refinement, and a deep understanding of the nuances of gamification. Only by addressing potential drawbacks and harnessing the most effective elements can we ensure that these digital innovations contribute meaningfully to the lifelong physical well-being of today's youth.

In conclusion, gamified fitness applications have the potential to be powerful allies in the battle against sedentary lifestyles, but their sustainability and true impact on physical literacy will only be realized through thoughtful, evidence-based design and implementation. By moving beyond the immediate allure of gaming and focusing on sustained engagement and development, we can help youth not only play the game but win at life.

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