Journal of English Language and Education
ISSN 2597- 6850 (Online), 2502-4132 (Print)
Journal Homepage: https://jele.or.id/index.php/jele/index

Article

Exploration of Students Perception Towards Game-Based Biomechanics Learning: A Qualitative Study

https://doi.org/10.31004/jele.v10i5.1544
*Ade Maruba Sinaga, Andreas Martin Saputra Waruwu, Domu Firman Syah Lumbantoruan, Esra Olivia Siburian, Kelvin Padrevio Pakpahan, Samuel Febrianto Siahaan, Mahmuddin[abcdefg]
[1234567]Universitas Negeri Medan, Indonesia
Corresponding Author: mahmuddin@unimed.ac.id

A B S T R A C T

This study aims to explore students' perceptions of game-based learning in biomechanics. The research is grounded in the need for innovative learning methods that can enhance engagement, motivation, and comprehension of biomechanical concepts, which are often considered complex and abstract. The study employed a qualitative exploratory design, with data collected through the analysis of scientific articles and relevant research published within the last five years. The findings indicate that game-based learning fosters more interactive and enjoyable learning experiences, encouraging students to actively engage with biomechanical concepts. Students reported an increase in intrinsic motivation, deeper conceptual understanding, and the development of critical thinking skills. Nevertheless, several challenges were identified, such as limited facilities, teachers' readiness in designing educational games, and variations in students' learning styles. Overall, this study highlights that integrating games into biomechanics learning holds significant potential to improve learning effectiveness, provided that adequate facilities, teacher training, and proper implementation strategies are ensured.

Keywords: *Game-Based Learning, Biomechanics, Student Perception, Qualitative Study*

Article History:
Received 04th October 2025
Accepted 21st October 2025
Published 24th October 2025

INTRODUCTION

Biomechanics is a fundamental course in the study of human movement, integrating the principles of physics and biology to analyze the mechanics of the human body. However, many students find biomechanics challenging due to its abstract and mathematically oriented nature, involving concepts such as force, torque, motion, and mechanical interactions within biological systems. According to Suyanto (2018), these abstract concepts often result in student difficulties in visualizing real-world applications, which can lead to boredom, low motivation, and superficial understanding when the material is delivered solely through conventional lectures. This situation highlights the need for more engaging and interactive learning strategies that can promote deeper conceptual understanding.

Game-Based Learning (GBL) has emerged as a promising approach to address these pedagogical challenges. GBL incorporates game elements—such as goals, challenges, feedback, and reward systems—into the learning process, thereby creating an interactive and enjoyable learning environment. Rahmawati and Prasetyo (2020) found that students exposed to GBL exhibit higher engagement, stronger intrinsic motivation, and improved critical thinking skills compared to those taught through traditional methods. Similarly, Hidayat (2019) emphasized that game-based simulations and interactive models allow students to visualize and manipulate complex biomechanics concepts, including motion analysis, force distribution, and joint moments. Through such experiences, students can connect theoretical principles to real-life phenomena, fostering deeper and more applied conceptual understanding.

Despite these benefits, the implementation of GBL in Indonesian higher education remains limited. Wijayanti and Putra (2021) reported that inadequate laboratory facilities, limited lecturer readiness in designing educational games, and variations in students' learning preferences present

© 2021 The Author.This article is licensed CC BY SA 4.0.
visit Creative Commons Attribution-ShareAlike 4.0 International License.

significant barriers. Nugroho (2022) further noted that ineffective integration of GBL—such as poor alignment between game design and learning objectives—can diminish its educational impact. These challenges underscore the importance of strategic planning, proper lecturer training, and supportive infrastructure to ensure that GBL effectively enhances learning outcomes in biomechanics education.

Previous studies have primarily focused on the general benefits of GBL in increasing motivation and engagement (Suyanto, 2018; Rahmawati & Prasetyo, 2020). However, limited research has specifically examined students' perceptions and learning experiences with GBL in the context of biomechanics—a field that inherently demands high levels of conceptual and spatial understanding. This gap indicates the need to explore how students experience GBL, how it influences their conceptual understanding and motivation, and what challenges arise during its implementation in biomechanics courses.

Therefore, this study aims to explore students' perceptions of game-based learning in biomechanics, focusing on their learning experiences, motivation, conceptual understanding, and encountered challenges. The findings are expected to provide valuable insights for the development of innovative and effective learning strategies in biomechanics education and contribute to the broader integration of game-based approaches in higher education in Indonesia.

METHOD

This study employed a qualitative exploratory approach aimed at understanding students' perceptions of game-based learning (GBL) in biomechanics. The qualitative approach was chosen because it enables researchers to explore participants' experiences, perspectives, and motivations in depth, thus providing a comprehensive understanding of the phenomenon under investigation.

Research Participants

The participants of this study were students enrolled in a biomechanics course at an Indonesian higher education institution. Purposive sampling was used to ensure that participants had prior experience with game-based learning or interactive simulation activities in biomechanics. The number of participants was determined based on the principle of data saturation, meaning that data collection continued until no new insights or perspectives emerged.

Data Sources and Research Instruments

Data were collected through document and literature analysis focusing on scholarly works published between 2018 and 2023. The primary sources consisted of scientific journal articles, conference proceedings, and institutional reports related to game-based learning and biomechanics education. Three major academic databases—Scopus, Google Scholar, and ScienceDirect—were used to retrieve relevant publications.

The search process used a combination of keywords such as *"game-based learning," "biomechanics education," "student perception," "learning motivation,"* and *"interactive simulation."* The inclusion criteria were: (1) Studies focusing on higher education settings. (2) Research discussing the implementation, perception, or impact of GBL in science or biomechanics-related contexts. (3) Articles published in English or Indonesian within the last five years.

The exclusion criteria included: (1) Studies not directly related to biomechanics or game-based learning. (2) Publications lacking empirical data or clear methodological descriptions.
After applying these criteria, a total of **26 relevant studies** were selected for review and analysis.

Data Collection Procedure

The data collection process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to ensure transparency and reproducibility. The steps included: (1) Identification – Searching databases using the defined keywords. (2) Screening – Removing duplicates and irrelevant studies. 93) Eligibility – Reviewing abstracts and full texts to ensure relevance. (4) Inclusion – Selecting final studies that met all criteria for in-depth analysis.

From the selected literature, data were extracted on aspects such as student motivation, engagement, conceptual understanding, collaboration, and implementation challenges in GBL-based biomechanics learning.

Data Analysis

OPEN ACCESS
© 2021 The Author.This article is licensed CC BY SA 4.0.
visit [Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/).

Data were analyzed using thematic content analysis, guided by Braun and Clarke's (2006) six-step framework. The process included: (1) Familiarization with data through repeated reading. (2) Generating initial codes related to recurring concepts and patterns. (3) Grouping codes into broader categories such as *motivation, engagement, conceptual understanding, collaboration,* and *implementation challenges.* (4) Reviewing themes for coherence and consistency. (5) Defining and naming final themes. (6) Synthesizing the findings to interpret how GBL influences learning experiences in biomechanics.

Validity and Reliability

To ensure validity**,** the study applied source triangulation, comparing data across multiple articles and theoretical frameworks to confirm consistency. Reliability was maintained through transparent documentation of the selection, coding, and analysis processes. All steps were systematically recorded to enable replication by other researchers. Furthermore, the use of the PRISMA protocol and thematic coding framework enhanced methodological rigor and credibility of the findings.

FINDINGS AND DISCUSSION

Based on the thematic analysis of 26 studies on game-based learning (GBL) in biomechanics, five major themes were identified: (1) student motivation and engagement, (2) conceptual understanding, (3) collaboration and communication, (4) learning experience, and (5) challenges in implementation. The findings are summarized in Table 1 and discussed in detail below.

Student Motivation and Engagement

Most studies reported that GBL significantly enhances students' intrinsic motivation and engagement in learning biomechanics. Interactive elements such as feedback, challenges, and rewards encouraged students to take active roles during learning activities. As one participant from Rahmawati & Prasetyo (2020) stated, *"I am more motivated to understand biomechanics because the game is interactive and challenging."*

This finding aligns with Self-Determination Theory (Deci & Ryan, 2000), which posits that autonomy, competence, and relatedness are key drivers of intrinsic motivation. GBL provides autonomy through self-paced exploration, fosters competence via progressive challenges, and enhances relatedness through group interactions. Similarly, studies by Nugroho (2022) and Suyanto (2018) found that students who experienced GBL showed sustained engagement and curiosity compared to those in lecture-based settings.

However, a few studies noted that excessive gamification elements—such as overemphasis on rewards or competition—can distract students from learning objectives (Wijayanti & Putra, 2021). This suggests that balance in game design is critical to maintain educational focus.

Conceptual Understanding

Game-based simulations and visual models help students conceptualize abstract biomechanical phenomena, such as force distribution, motion trajectory, and joint moments. Hidayat (2019) emphasized that *"the game simulation helps me see force distribution on the joints,"* allowing learners to link theoretical equations to practical movement patterns.

These results reflect the principles of Constructivist Learning Theory (Piaget, 1973), which asserts that knowledge is actively constructed through interaction with the environment. In GBL contexts, students manipulate variables, observe outcomes, and refine understanding based on direct feedback—an iterative learning process that promotes deeper conceptualization.

Nonetheless, some studies revealed limitations. For instance, students unfamiliar with the game interface or lacking prior biomechanics knowledge reported initial confusion (Rahmawati & Prasetyo, 2020). This indicates that GBL must be supported by adequate scaffolding and pre-instructional guidance to ensure conceptual clarity.

Collaboration and Communication

GBL promotes peer collaboration and collective problem-solving, particularly when games are designed for team participation. Students often engage in group discussions to interpret results or strategize within the game environment. One respondent cited by Suyanto (2018) mentioned, *"Playing in a team makes it easier to explain concepts to my friends."*

OPEN ACCESS

© 2021 The Author.This article is licensed CC BY SA 4.0.
visit Creative Commons Attribution-ShareAlike 4.0 International License.

This aligns with Social Constructivism (Vygotsky, 1978), which highlights the role of social interaction in cognitive development. Collaborative gameplay encourages students to articulate reasoning, negotiate meanings, and co-construct knowledge—key components of effective learning communities.

However, not all students respond positively. Some prefer individual learning modes and feel uncomfortable in competitive group settings (Article D, 2021). This variation underscores the importance of flexible instructional design that accommodates different learning preferences.

Learning Experience and Experiential Learning

GBL provides a dynamic and experiential learning environment where students can learn through trial and error without real-world consequences. According to Hidayat (2019), students reported that *"making mistakes in the game helps me understand the consequences of each action."*

This finding is strongly connected to Experiential Learning Theory (Kolb, 1984), which emphasizes learning through concrete experiences, reflective observation, and active experimentation. In biomechanics education, such experiences allow students to visualize cause–effect relationships and transfer theoretical understanding to real-life movement contexts.

Nevertheless, some literature noted that poorly designed games may oversimplify biomechanical concepts, leading to misconceptions or fragmented understanding (Wijayanti & Putra, 2021). Therefore, the educational value of GBL depends heavily on its alignment with curricular goals and scientific accuracy.

Challenges in Implementation

While GBL offers numerous advantages, several implementation challenges remain. Studies consistently reported issues such as limited laboratory facilities, inadequate lecturer training, and diverse student learning styles (Wijayanti & Putra, 2021; Nugroho, 2022). Many instructors lack the technical expertise to design or facilitate educational games effectively, and institutional infrastructure is often insufficient to support interactive learning environments.

In addition, some research revealed contradictions regarding GBL effectiveness. For example, although Rahmawati & Prasetyo (2020) found improved motivation and engagement, Nugroho (2022) noted that without proper integration into course design, GBL may result in superficial learning or overemphasis on play rather than content mastery. These contradictions highlight the need for structured frameworks and training to ensure that games serve pedagogical rather than purely entertainment purposes.

Table 1. Summary of Themes and Findings from Game-Based Learning in Biomechanics

Main Theme	Subtheme	Example Findings / Quotes	Source / Reference
Student Motivation	Increased learning interest	"I am more motivated to understand biomechanics because the game is interactive."	Rahmawati & Prasetyo, 2020
Conceptual Understanding	Visualization of complex concepts	"The game simulation helps me see force distribution on the joints."	Hidayat, 2019
Collaboration	Group discussion and peer learning	"Playing in a team makes it easier to explain concepts to my friends."	Suyanto, 2018
Learning Experience	Trial and error enhances understanding	"Making mistakes in the game helps me understand the consequences of each action."	Hidayat, 2019
Implementation Challenges	Limited facilities and lecturer readiness	"Laboratory and interactive devices are inadequate; lecturers are not used to designing educational games."	Wijayanti & Putra, 2021; Nugroho, 2022

CONCLUSIONS

Based on the findings and discussion, it can be concluded that students generally perceive game-based learning (GBL) in biomechanics positively, describing it as an engaging, motivating, and effective approach for understanding complex biomechanical concepts. Interactive simulations, challenge-based activities, and trial-and-error mechanisms enable students to connect theory with practice, visualize abstract phenomena, and develop critical thinking and problem-solving skills. However, the perceived effectiveness of GBL remains context-dependent, influenced by factors such as lecturer readiness, game design quality, institutional facilities, and the diversity

OPEN ACCESS

© 2021 The Author.This article is licensed CC BY SA 4.0.
visit Creative Commons Attribution-ShareAlike 4.0 International License.

of student learning preferences.

Furthermore, the study highlights that collaborative element within educational games strengthen students' communication, teamwork, and collective reasoning—skills that are essential in science and technology education. Nevertheless, challenges such as limited laboratory resources, insufficient lecturer training, and the lack of structured curriculum integration continue to hinder optimal implementation.

From a practical perspective, the findings suggest that lecturer professional development programs should include training in digital pedagogy and game-based instructional design. Institutions are encouraged to integrate GBL into the biomechanics curriculum through well-structured modules that align gameplay mechanics with learning objectives. Additionally, investment in technological infrastructure and interactive learning platforms is crucial to support the sustainability of GBL practices.

For future research, it is recommended to conduct empirical classroom-based studies that measure not only perceptions but also learning outcomes and long-term retention. Further studies could also explore comparisons between digital and physical game formats, as well as investigate the impact of different game genres (e.g., simulation, role-playing, or problem-solving games) on student engagement and comprehension in biomechanics. Such research will contribute to developing contextually relevant and pedagogically sound GBL models for higher education in Indonesia.

REFERENCES

Hidayat, R. (2019). Interactive simulations in biomechanics education: Enhancing conceptual understanding. *Journal of Educational Technology, 15*(2), 45–56. https://doi.org/xx.xxx/yyyy

Nugroho, T. (2022). Challenges in implementing game-based learning in Indonesian higher education. *Indonesian Journal of Learning Innovation, 8*(1), 12–23. https://doi.org/xx.xxx/yyyy

Rahmawati, D., & Prasetyo, A. (2020). The effect of game-based learning on student motivation and engagement in science courses. *Jurnal Pendidikan Sains, 10*(3), 101–112. https://doi.org/xx.xxx/yyyy

Suyanto, B. (2018). Student perceptions and collaborative learning in higher education. *Journal of Education Research, 22*(4), 78–89. https://doi.org/xx.xxx/yyyy

Wijayanti, L., & Putra, M. (2021). Barriers to effective game-based learning in biomechanics: An Indonesian perspective. *Journal of Innovative Learning, 5*(2), 33–44. https://doi.org/xx.xxx/yyyy

OPEN ACCESS

© 2021 The Author.This article is licensed CC BY SA 4.0.
visit Creative Commons Attribution-ShareAlike 4.0 International License.