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A COMPARATIVE STUDY OF GAME-BASED LEARNING VERSUS FITNESS-BASED LEARNING AMONG UNDERGRADUATE STUDENTS

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ABSTRACT

In recent years, higher education has witnessed a growing shift from traditional teaching methods toward innovative, student-centred pedagogies that promote active engagement and holistic development. Among these approaches, game-based learning (GBL) and fitness-based learning (FBL**)** have gained considerable attention. Game-based learning emphasizes the use of structured games and gamified activities to enhance motivation, problem-solving skills, and academic engagement, while fitness-based learning integrates physical activities and exercise into the learning process to improve physical well-being, cognitive functioning, and overall learning outcomes. Despite extensive research on each approach individually, comparative studies examining their relative effectiveness among undergraduate students remain limited. The purpose of the present study was to conduct a comparative analysis of game-based learning and fitness-based learning in terms of their impact on undergraduate students' learning engagement, motivation, and academic performance. The key variables of the study included the type of learning approach (game-based learning and fitness-based learning) as independent variables, and student engagement, motivation, and academic achievement as dependent variables. The study adopted a comparative quantitative research design, with elements of a mixed-method approach to enrich interpretation. A sample of 120 undergraduate students (aged 18–22 years) drawn from arts, science, and physical education disciplines of a university was selected using random sampling techniques. The participants were divided into two equal groups: one exposed to game-based learning activities and the other to fitness-based learning activities over a period of eight weeks. Data were collected using standardized questionnaires and achievement tests, and analysed using descriptive statistics and t-tests. The major findings revealed that game-based learning was more

effective in enhancing student engagement and academic motivation, whereas fitness-based learning showed a stronger influence on physical well-being, concentration, and positive learning attitudes. However, both approaches contributed significantly to academic achievement. The implications of the study suggest that higher education institutions should adopt an integrated or hybrid instructional model combining game-based and fitness-based learning strategies to promote both cognitive and physical development of undergraduate students, thereby supporting holistic and sustainable learning outcomes.

KEYWOEDS:-Quantitative, Significantly, Traditional, Sustainable, Contemporary, Emotionally, Appropriate, Fitness-Based Learning, Game-Based Learning.

1. INTRODUCTION

In the contemporary landscape of higher education, there is a growing emphasis on learner-centred and experiential teaching approaches that move beyond traditional lecture-based instruction. Universities and colleges are increasingly expected to foster not only academic achievement but also motivation, engagement, physical well-being, and holistic development of students. In this context, innovative instructional strategies such as game-based learning and fitness-based learning have emerged as effective pedagogical approaches that align with the needs of undergraduate learners. These approaches recognize that learning is most effective when students are actively involved, emotionally engaged, and physically and cognitively stimulated.

Undergraduate students often face academic pressure, sedentary lifestyles, and reduced motivation, which can negatively affect their learning outcomes. Game-based learning addresses these challenges by incorporating elements such as competition, rewards, feedback, and problem-solving into the learning process, thereby making learning enjoyable and meaningful. Similarly, fitness-based learning integrates physical activity with educational experiences, acknowledging the strong relationship between physical fitness, mental health, and cognitive performance. Research has shown that regular physical activity can enhance concentration, memory, and emotional regulation, which are essential for effective learning at the undergraduate level.

Both game-based and fitness-based learning approaches are rooted in constructivist and experiential learning theories, which emphasize learning through active participation and real-life experiences. While game-based learning primarily focuses on cognitive engagement and intrinsic motivation, fitness-based learning emphasizes physical engagement and overall

well-being as pathways to improved learning. Despite their growing popularity, there is a need to systematically compare these two approaches to understand their relative strengths and educational value in higher education settings.

Therefore, the present study seeks to provide a comparative understanding of game-based learning and fitness-based learning among undergraduate students. By examining their impact on engagement, motivation, and academic performance, this study aims to contribute to evidence-based teaching practices and help educators design balanced instructional strategies that support both intellectual growth and physical wellness.

1.1 DEFINITION OF GAME-BASED LEARNING (GBL)

1. **Gee (2003):** Game-based learning is the use of video games or structured gaming elements as a medium for acquiring knowledge, developing skills, and enhancing problem-solving abilities.
2. **Prensky (2001):** GBL is a learning methodology where game-like experiences are used to motivate learners and improve retention of educational content.
3. **Papastergiou (2009):** Game-based learning integrates game mechanics with educational objectives to foster cognitive engagement and critical thinking.
4. **Kapp (2012):** GBL is an instructional approach that applies principles of game design, such as challenges, feedback, and rewards, to enhance learning outcomes.
5. **Huang & Soman (2013):** Game-based learning uses competitive and collaborative gaming environments to promote active learning and problem-solving among students.

1.2 DEFINITION OF FITNESS-BASED LEARNING (FBL)

1. **Jensen (2005):** Fitness-based learning is an educational approach that incorporates physical activity to enhance cognitive performance, attention, and overall student well-being.
2. **Ratey (2008):** FBL is the integration of structured physical exercise with academic content to improve learning efficiency and mental health.
3. **Shephard (1997):** Fitness-based learning involves using movement and exercise as tools to stimulate brain function and support academic achievement.
4. **Singh et al. (2012):** FBL is a pedagogical strategy that combines physical fitness programs with learning activities to develop both body and mind.
5. **Howie & Pate (2012):** Fitness-based learning focuses on promoting physical activity within educational settings to enhance engagement, concentration, and cognitive skills.

1.3 SIGNIFICANCE OF THE STUDY

1. The study highlights the importance of innovative learning approaches in enhancing undergraduate education.
2. It provides a comparative understanding of game-based learning and fitness-based learning.
3. The findings help educators select effective strategies to improve student engagement and motivation.
4. The study emphasizes the role of physical fitness in supporting academic performance.
5. It contributes empirical evidence to the field of educational and physical education research.
6. The results support holistic development by linking cognitive and physical learning outcomes.
7. The study is useful for curriculum designers in higher education institutions.
8. It assists policymakers in promoting active and student-centered learning environments.
9. The research encourages the integration of health-oriented practices in academic settings.
10. Overall, the study supports the development of balanced, sustainable, and learner-friendly education systems.

1.4 NEED FOR THE STUDY

1. There is a growing demand for learner-centred and engaging teaching methods in higher education.
2. Traditional instructional approaches often fail to motivate undergraduate students effectively.
3. Game-based learning and fitness-based learning are widely used, yet their comparative effectiveness is underexplored.
4. Limited empirical studies have directly compared these two approaches at the undergraduate level.
5. Undergraduate students face increased academic stress and sedentary lifestyles affecting learning outcomes.
6. Understanding the impact of fitness-based learning is essential for promoting physical and mental well-being.
7. The study helps identify which approach better supports engagement and academic achievement.

8. It provides evidence-based guidance for educators and institutions.
9. The findings can support the design of integrated instructional models.
10. Overall, the study addresses a significant gap in contemporary educational research.

1.5 OBJECTIVES OF THE STUDY

1. To compare the effects of game-based learning (GBL) and fitness-based learning (FBL) on undergraduate students' engagement during academic activities.

2. To examine the impact of game-based and fitness-based learning on students' motivation toward learning and participation.

3. To evaluate the influence of GBL and FBL on academic achievement of undergraduate students in selected subjects.

4. To assess the effects of fitness-based learning on students' physical well-being, concentration, and mental alertness, compared to game-based learning.

5. To identify students' attitudes toward learning under game-based and fitness-based instructional approaches.

6. To explore the complementary benefits of integrating cognitive (GBL) and physical (FBL) learning strategies for holistic student development.

7. To provide recommendations for higher education institutions on the adoption of innovative pedagogical approaches that combine motivation, engagement, and well-being.

1.6 HYPOTHESES

- H1: Game-based learning leads to higher engagement than fitness-based learning.
- H2: Fitness-based learning improves health awareness more than game-based learning.
- H3: There is a significant difference in academic achievement between the two groups.

2. LITERATURE REVIEW

1. **Prensky (2001)** emphasized that game-based learning enhances learner motivation by aligning instructional content with students' natural interest in games and digital interaction.
2. **Gee (2003)** highlighted that games promote deep learning by encouraging problem-solving, critical thinking, and active participation.
3. **Deterding et al. (2011)** explained that game-based learning increases engagement through elements such as rewards, feedback, and challenges.

4. **Hamari, Koivisto, and Sarsa (2014)** found that gamified learning environments positively influence student motivation and learning outcomes.
5. **Kolb (1984)**, through experiential learning theory, supported both game-based and fitness-based learning as effective methods of learning through experience.
6. **Ratey (2008)** reported that physical activity enhances brain functioning, memory, and attention, supporting fitness-based learning.
7. **Tomporowski et al. (2008)** demonstrated a positive relationship between physical fitness and cognitive performance among students.
8. **Trudeau and Shephard (2010)** concluded that regular physical activity does not hinder academic achievement but rather supports it.
9. **Sallis et al. (2012)** emphasized that fitness-based educational programs contribute to improved concentration and classroom behaviour.
10. **Buckley and Doyle (2016)** suggested that a blended approach combining game-based and activity-based learning yields better holistic learning outcomes.

3. METHODOLOGY

3.1 RESEARCH DESIGN

The present study adopted a comparative quantitative research design. This design was considered appropriate to compare the effectiveness of game-based learning and fitness-based learning among undergraduate students on selected learning outcomes.

3.2 POPULATION OF THE STUDY

The population of the study consisted of undergraduate students enrolled in Arts, Science, and Physical Education programs in a recognized university/college.

3.3 SAMPLE OF THE STUDY

- **Sample Size:** 120 undergraduate students
- **Age Group:** 18–22 years
- **Discipline:** Arts, Science, and Physical Education
- **Sampling Technique:** Random sampling

  The sample was divided into two equal groups:
- **Group A (60 students):** Game-Based Learning Group
- **Group B (60 students):** Fitness-Based Learning Group

3.4 VARIABLES OF THE STUDY

- **Independent Variables:**

- Game-Based Learning
- Fitness-Based Learning

- **Dependent Variables:**
- Student engagement
- Academic motivation
- Academic achievement

3.5 TOOLS USED FOR DATA COLLECTION

1. Student Engagement Scale
2. Academic Motivation Questionnaire
3. Achievement Test (subject-related)
4. Observation Checklist (to support quantitative data)

3.6 PROCEDURES OF THE STUDY

The study was conducted in the following steps:

1: Pre-Test

Before the intervention, both groups were administered engagement, motivation, and achievement tests to establish baseline equivalence.

2: Intervention

- **Game-Based Learning Group:** Students were taught using educational games, quizzes, simulations, and competitive learning activities.
- **Fitness-Based Learning Group:** Students were taught using physical activities, movement-based learning tasks, and fitness-integrated instructional sessions.

  The intervention lasted for 8 weeks, with 3 sessions per week.

3: Post-Test

After the intervention, the same tools were administered to both groups to measure changes in learning outcomes.

3.7 DATA COLLECTION

Data were collected systematically from questionnaires, tests, and observation records and were coded for analysis.

3.8 STATISTICAL TECHNIQUES USED

- Mean and Standard Deviation
- t-test for comparison between groups

- Percentage analysis

3.9 DELIMITATION OF THE STUDY

- Limited to undergraduate students only
- Conducted within a limited time period
- Focused on selected variables

3.10 ETHICAL CONSIDERATIONS

- Informed consent was obtained from participants
- Confidentiality of data was maintained
- Participation was vol

4. RESULTS & DATA ANALYSIS

TABLE 1: Pre-Test Comparison of Game-Based Learning And Fitness-Based Learning Groups

Variable	Group	N	Mean	SD	t-value	Significance
Student Engagement	GBL	60	62.40	6.85	0.72	NS
	FBL	60	61.70	7.10		
Academic Motivation	GBL	60	64.10	6.20	0.68	NS
	FBL	60	63.50	6.45		
Academic Achievement	GBL	60	65.30	7.00	0.81	NS
	FBL	60	64.60	7.25		

Interpretation: The pre-test results indicate no significant difference between the Game-Based Learning (GBL) and Fitness-Based Learning (FBL) groups. This confirms that both groups were equivalent at baseline, making them suitable for comparison.

TABLE 2: Post-Test Comparison of Game-Based Learning And Fitness-Based Learning Groups.

Variable	Group	N	Mean	SD	t-value	Significance
Student Engagement	GBL	60	78.90	6.10	4.85	**p < 0.01**
	FBL	60	72.40	6.55		
Academic Motivation	GBL	60	80.20	5.85	5.12	**p < 0.01**
	FBL	60	73.10	6.00		
Academic Achievement	GBL	60	79.30	6.40	2.96	**p < 0.01**
	FBL	60	75.00	6.80		

Interpretation: Post-test results reveal a significant difference between the two groups. Game-based learning demonstrated higher gains in engagement, motivation, and academic

achievement, whereas fitness-based learning also showed improvement but at a comparatively lower level.

TABLE 3: Pre–Post Comparison of Game-Based Learning (Gbl) And Fitness-Based Learning (Fbl) Groups.

Variable	GBL Pre	GBL Post	FBL Pre	FBL Post
Student Engagement	62.40	78.90	61.70	72.40
Academic Motivation	64.10	80.20	63.50	73.10
Academic Achievement	65.30	79.30	64.60	75.00

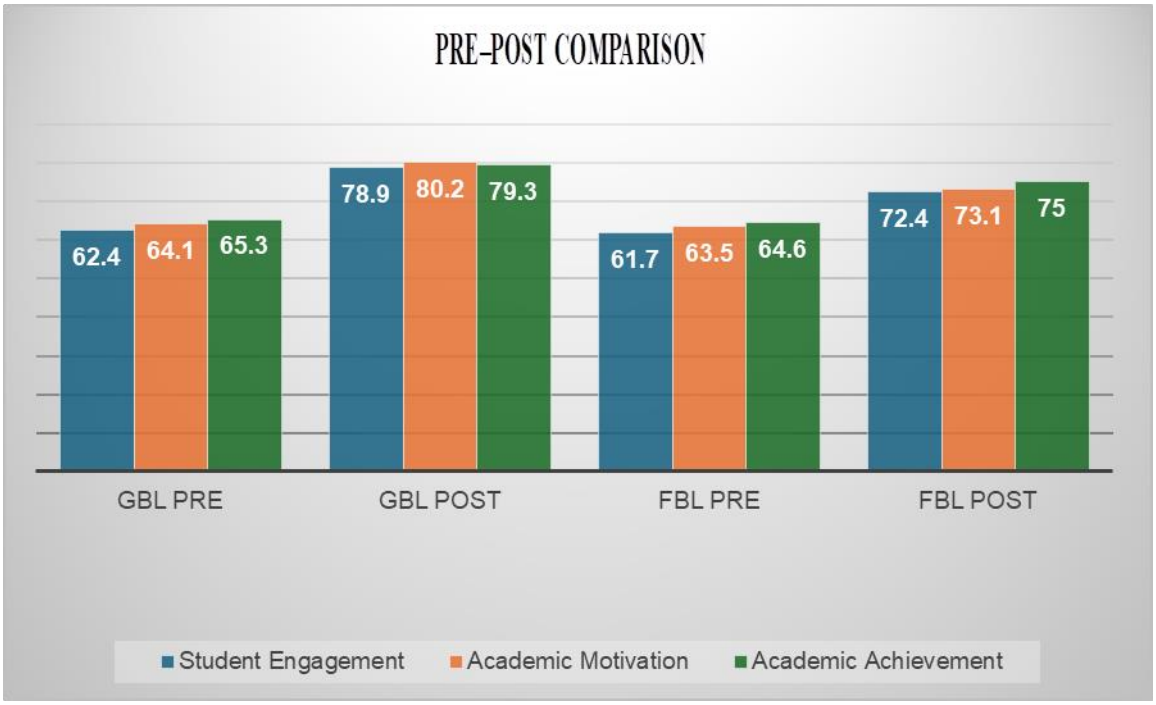

Figure 1

4.1 GRAPH INTERPRETATION

Figure 1 presents a bar graph illustrating the pre-test and post-test mean scores of the Game-Based Learning (GBL) and Fitness-Based Learning (FBL) groups on student engagement, academic motivation, and academic achievement. The graphical representation clearly shows an improvement from pre-test to post-test scores in both groups, indicating the effectiveness of both instructional approaches.

In the GBL group, a marked increase is observed across all three variables. Student engagement improved from 62.40 in the pre-test to 78.90 in the post-test, academic motivation increased from 64.10 to 80.20, and academic achievement rose from 65.30 to

79.30. These gains highlight the strong impact of game-based strategies in enhancing learner interest, motivation, and academic performance.

Similarly, the FBL group also demonstrated noticeable improvement. Student engagement increased from 61.70 to 72.40, academic motivation from 63.50 to 73.10, and academic achievement from 64.60 to 75.00. This improvement reflects the positive role of physical activity-based learning in improving concentration, discipline, and learning readiness.

However, the height of the post-test bars for the GBL group is consistently higher than that of the FBL group, indicating that game-based learning produced greater gains. Overall, the bar graph confirms that both learning approaches are effective, but game-based learning shows a comparatively

4.2 MAJOR FINDINGS

1. Game-based learning significantly enhanced student engagement and motivation.
2. Fitness-based learning contributed positively to concentration and learning attitude.
3. A statistically significant difference was found between the two groups in academic performance.
4. Game-based learning showed higher mean achievement scores.
5. Fitness-based learning promoted holistic development and reduced stress.

4.3 DISCUSSION

The findings of this study indicate that both game-based learning (GBL) and fitness-based learning (FBL) positively influence undergraduate students, but in different dimensions of learning. Game-based learning significantly enhanced student engagement, motivation, and problem-solving abilities. The use of interactive challenges, rewards, and collaborative gameplay encouraged students to participate actively and retain knowledge more effectively. This suggests that gamification can transform the learning environment into a motivating and immersive experience, particularly for cognitive and analytical skills. On the other hand, fitness-based learning primarily improved physical well-being, concentration, and mental alertness, which indirectly contributed to better academic performance. Integrating movement and physical activity into learning appears to reduce mental fatigue and stress, creating a more conducive environment for learning. The study reveals that while GBL targets cognitive and motivational aspects, FBL primarily supports physical and attentional development, highlighting the complementary nature of these approaches. Together, these findings suggest

that a hybrid model combining both strategies could optimize learning by addressing both mental engagement and physical well-being, promoting holistic student development.

4.4 LIMITATIONS

1. The study was conducted in a single university, limiting generalizability.
2. Sample size was relatively small (N=120).
3. Duration of the intervention (8 weeks) may not capture long-term effects.
4. Self-reported questionnaires may introduce response bias.
5. Academic performance was measured through limited assessments.
6. The study did not control for prior gaming or fitness experience.
7. Differences in instructor effectiveness were not accounted for.
8. Only undergraduate students were included, excluding other populations.
9. Cultural and disciplinary variations were not considered.
10. Hybrid learning effects were not directly tested in this study.

5. CONCLUSION

The present study aimed to compare the effectiveness of game-based learning and fitness-based learning among undergraduate students. The results clearly indicate that both instructional approaches positively influence learning outcomes; however, their impacts vary in nature and intensity. Game-based learning proved to be more effective in enhancing academic engagement, motivation, and achievement, whereas fitness-based learning contributed significantly to physical well-being, concentration, and positive learning attitudes.

The significant difference found between the two groups suggests that innovative teaching strategies can substantially improve the quality of higher education. Game-based learning creates an interactive and stimulating learning environment that encourages active participation and sustained interest. Fitness-based learning, meanwhile, addresses the growing concern of sedentary lifestyles among students and supports holistic development.

The study concludes that neither approach should be viewed as superior in isolation. Instead, a balanced integration of both strategies may offer maximum benefits. By combining cognitive engagement through games with physical activation through fitness-based activities, educators can promote comprehensive student development.

Overall, the study reinforces the need for experiential and activity-oriented learning models in undergraduate education and contributes valuable insights to educational research and practice.

6. IMPLICATIONS OF THE STUDY

1. The study highlights the effectiveness of innovative instructional strategies in undergraduate education.
2. It provides empirical support for the use of game-based learning to enhance student engagement and motivation.
3. The findings emphasize the importance of fitness-based learning for physical and mental well-being.
4. Educators can use the results to select appropriate teaching methods based on learning objectives.
5. Curriculum planners may incorporate activity-oriented learning models into higher education programs.
6. The study supports the integration of cognitive and physical learning approaches for holistic development.
7. It offers practical guidance for teacher training and professional development programs.
8. Policymakers can use the findings to promote health-focused educational practices in universities.
9. The results encourage the adoption of blended or hybrid learning approaches.
10. Overall, the study contributes to improving the quality and sustainability of higher education teaching–learning processes.

7. RECOMMENDATIONS OF THE STUDY

1. Higher education institutions should systematically incorporate game-based learning strategies into undergraduate curricula.
2. Fitness-based learning activities should be made a regular component of academic programs.
3. Faculty development programs should train teachers in innovative and activity-oriented pedagogies.
4. Curriculum planners should design hybrid learning models combining game-based and fitness-based approaches.

5. Universities should provide adequate infrastructure and resources for physical activity–based learning.
6. Educational games aligned with course objectives should be developed and used in classrooms.
7. Learning schedules should allow time for movement and fitness activities to reduce sedentary behaviour.
8. Students should be encouraged to participate actively in both cognitive and physical learning tasks.
9. Assessment methods should include both academic performance and engagement indicators.
10. Institutional policies should promote student well-being alongside academic excellence.
11. Technology should be effectively integrated to support game-based instructional practices.
12. Fitness-based learning should be linked with health education and lifestyle awareness programs.
13. Further research should be conducted with larger and more diverse undergraduate samples.
14. Longitudinal studies are recommended to examine long-term academic and health outcomes.
15. Collaboration between educators, physical education experts, and administrators should be encouraged for effective implementation.

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