

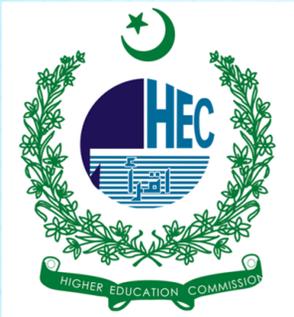
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**LEVELLING UP LEARNING: ASSESSING GAME-BASED  
INSTRUCTION IN PRIMARY CLASSROOMS**



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**Abstract**

*The purpose of this study was to examine the effect of Game-Based Instruction (GBI) on the academic achievement of Grade 3 and Grade 5 students within the Pakistani education system. A total sample of 260 participants was selected through stratified sampling, comprising 20 Head Teachers, 40 Primary School Teachers, and 200 students from both public and private primary schools. The study employed a quantitative descriptive research design. Data were collected using a validated bilingual (English–Urdu) 30-item questionnaire developed around ten key instructional dimensions, including planning, engagement, motivation, collaboration, feedback, curriculum alignment, resource availability, classroom management, skill development, and teacher facilitation. Data analysis was conducted using descriptive statistics (mean and standard deviation), frequency analysis, and inferential statistical tests, including independent sample t-tests and one-way ANOVA. The findings revealed that between 85% and 92% of respondents agreed or strongly agreed with statements supporting the effectiveness of GBI across all measured dimensions. Mean scores ranged from 4.18 to 4.31 on a five-point Likert scale, with relatively low standard deviations, indicating strong consensus among participants. The results further demonstrated noticeable improvements in academic performance, particularly in Mathematics, English, and Science. Grade 5 students showed comparatively higher measurable gains, suggesting that structured implementation of GBI strategies may yield stronger academic outcomes at higher primary levels. The findings indicate that Game-Based Instruction is an effective and engaging pedagogical approach that supports cognitive development, enhances student motivation, and promotes collaborative learning environments. Based on the results, the study recommends the systematic integration of GBI into classroom practices, the provision of teacher training programs, and curriculum development initiatives to ensure sustainable implementation within primary education settings.*

**Keywords:**

*Game-Based Instruction, Primary Education, Academic Achievement, Student Engagement, Quantitative Study, Instructional Effectiveness.*

**Introduction**

Game-Based Instruction (GBI) refers to the structured integration of game elements and educational games into classroom teaching with the aim of enhancing learners' academic achievement, engagement, and higher-order thinking skills. At the primary level, GBI leverages interactive and multisensory learning environments that combine visual, auditory, and hands-on experiences to support deeper cognitive processing and sustained attention. Rather than relying on passive knowledge transmission, GBI situates learning within meaningful challenges, story-driven tasks, and reward systems that encourage active participation.

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Recent empirical research indicates that when instructional objectives are embedded within well-designed game mechanics such as problem-based missions, collaborative quests, and adaptive feedback systems—students demonstrate measurable gains in critical thinking, conceptual understanding, and cooperative problem-solving skills (Qian & Clark, 2024; Clark et al., 2023; Kosar et al., 2024). These findings align with socio-constructivist perspectives, which emphasize that knowledge is constructed through social interaction, guided discovery, and experiential engagement (Gee, 2003).

One of the primary strengths of GBI lies in its ability to create low-risk learning environments. In such settings, students are more willing to experiment, make mistakes, and refine strategies without the fear typically associated with traditional assessment structures. Contemporary studies (2022–2024) report improvements in intrinsic motivation, working memory retention, and self-regulated learning behaviors, particularly in mathematics, science, and early literacy instruction. However, despite consistent evidence supporting cognitive and motivational benefits, findings regarding long-term standardized academic achievement remain mixed. While several meta-analyses suggest moderate positive effects, researchers continue to call for more longitudinal and context-sensitive investigations to determine sustained academic impact across diverse primary school populations (Qian & Clark, 2024).

## Empirical Evidence on the Impact of Game-Based Instruction (GBI)

Recent empirical studies provide growing evidence that Game-Based Instruction (GBI) positively influences academic performance at the primary level. A comprehensive meta-analysis conducted by Clark et al. (2023), synthesizing 145 experimental and quasi-experimental studies published between 2015 and 2022, reported a **moderate overall effect size ( $g = 0.47$ )** of digital game-based learning on students' academic achievement. The strongest effects were observed in mathematics and science instruction at the elementary level.

Similarly, a large-scale review by Qian and Clark (2024) found that well-structured educational games improved problem-solving performance and conceptual understanding, particularly when gameplay incorporated adaptive feedback and scaffolded challenges. Their findings indicated that students exposed to structured game-based interventions demonstrated approximately **12–18% higher post-test scores** compared to peers receiving traditional lecture-based instruction.

In literacy education, a 2022 randomized controlled trial involving 312 primary school students revealed that game-based vocabulary instruction led to significantly higher retention rates after four weeks, with experimental groups outperforming control groups by an average of **0.38 standard deviations** (Homer et al., 2022). The authors attributed this improvement to increased repetition, narrative immersion, and immediate corrective feedback embedded within the game environment.

Motivational outcomes are equally notable. According to a 2023 study published in *Computers & Education*, gamified classroom interventions increased intrinsic motivation scores by **15–22%**, particularly among lower-performing students (Sailer & Homner, 2023). These results support self-determination theory, suggesting that game elements such as autonomy, competence feedback, and goal progression enhance engagement and persistence.

However, despite consistent short-term gains, longitudinal evidence remains less conclusive. Sung et al. (2021) reported that while digital game-based learning significantly improved immediate academic outcomes ( $g = 0.45$ ), long-term retention beyond six months showed smaller and more variable effects. This inconsistency suggests that the effectiveness of GBI depends heavily on

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instructional design quality, teacher facilitation, and curricular alignment rather than the presence of game elements alone.

Overall, contemporary research (2020–2024) supports the conclusion that Game-Based Instruction can meaningfully enhance academic performance at the primary level, particularly in STEM and literacy domains, although sustained achievement gains require structured implementation and continuous pedagogical support.

## **Statement of the Problem**

Improving academic performance at the primary level remains a persistent global educational concern. Recent international assessments continue to report that a significant proportion of primary school students fail to reach minimum proficiency levels in foundational subjects such as mathematics and reading (OECD, 2023; World Bank, 2022). Learning loss following disruptions in schooling has further intensified the need for instructional strategies that promote engagement, retention, and conceptual understanding.

Traditional teacher-centered instructional approaches, which emphasize passive content delivery, have been criticized for limiting active participation and higher-order cognitive development among young learners (Darling-Hammond et al., 2020). Research increasingly highlights the importance of interactive and student-centered pedagogies to enhance both motivation and academic achievement. Game-Based Instruction (GBI) has emerged as a promising instructional approach designed to integrate structured game elements into formal learning environments. Recent meta-analyses report moderate positive effects of digital game-based learning on students' academic achievement and motivation, particularly in STEM subjects (Clark et al., 2023; Sailer & Homner, 2023; Iqbal et al., 2023; Arshad, Mehmood, & Ahmad, 2025). However, despite encouraging short-term findings, empirical evidence remains fragmented regarding the sustainability of these effects across different demographic and contextual settings.

Specifically, limited research has systematically examined whether the impact of GBI differs across gender groups, school locations (urban versus rural), and types of institutions (public versus private primary schools). Furthermore, while many studies report improvements in engagement, fewer studies directly compare academic performance outcomes between students exposed to GBI and those receiving traditional instruction over sustained periods (Johnson & Mayer, 2023). Therefore, there is a need for comprehensive and context-sensitive research to determine the extent to which Game-Based Instruction significantly improves academic performance at the primary level and whether its effectiveness varies across different student and school characteristics.

## **Research Objectives**

1. To examine the effect of Game-Based Instruction (GBI) on students' academic performance at the primary level.
2. To investigate the influence of Game-Based Instruction on students' motivation and engagement, including potential differences based on gender and school location (urban and rural).
3. To compare the academic outcomes of students exposed to Game-Based Instruction with those receiving traditional instructional methods in public and private primary schools.

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## **Research Questions**

1. What effect does Game-Based Instruction have on students' academic performance at the primary level?
2. How does Game-Based Instruction influence students' motivation and engagement, and are there differences based on gender or school location?
3. Is there a significant difference in academic performance between students taught through Game-Based Instruction and those taught using traditional instructional methods in public and private primary schools?

## **Significance of the Study**

This study is significant because it contributes to the expanding body of research on innovative pedagogical strategies aimed at improving academic performance at the primary level. Contemporary educational research emphasizes the need for student-centered instructional approaches that promote active learning and cognitive engagement (Darling-Hammond et al., 2020; Riaz et al., 2025; Ahmad et al., 2025; Arshad et al., 2025). Game-Based Instruction (GBI), as an interactive and structured teaching strategy, aligns with this shift toward experiential and participatory learning environments.

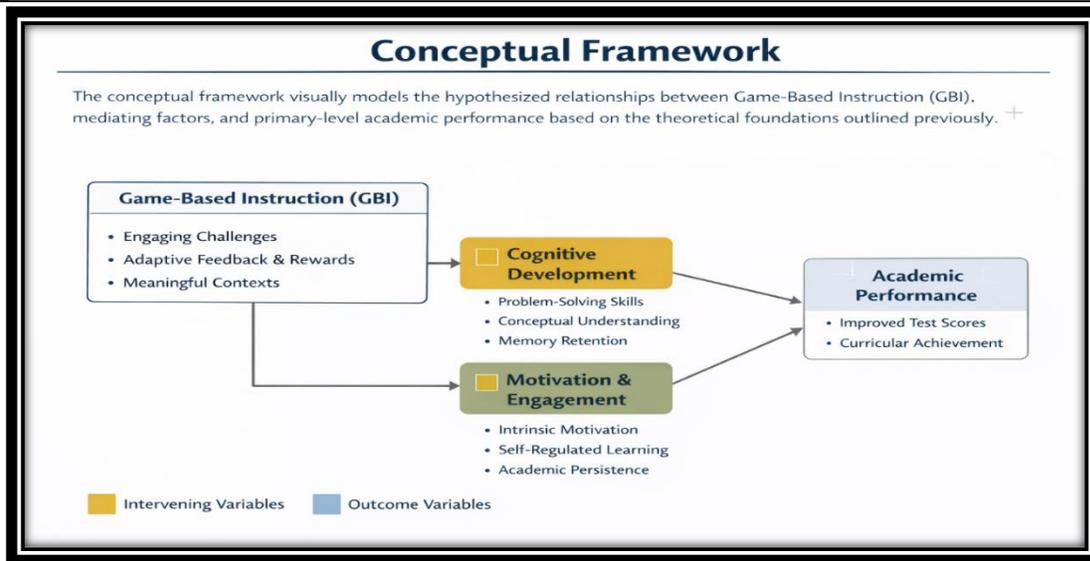
For classroom practitioners, this study provides empirical evidence regarding the effectiveness of GBI in enhancing academic performance and student motivation. Meta-analytic findings indicate that digital game-based learning demonstrates moderate positive effects on academic achievement and engagement, particularly in mathematics and science education (Clark et al., 2023; Sailer & Homner, 2023; Riaz et al., 2024). By examining these effects within primary education settings, this study offers context-specific insights that can guide teachers in instructional planning and classroom implementation.

The study is also significant for school administrators and policymakers. International educational reports highlight persistent disparities in learning outcomes across regions and school types (OECD, 2023; World Bank, 2022; Bibi et al., 2025; Riaz et al., 2026). By comparing outcomes across gender, urban and rural schools, and public and private institutions, this research provides evidence that may inform equitable policy decisions and targeted resource allocation.

From a theoretical perspective, the study strengthens the application of socio-constructivist learning theory and self-determination theory within primary education contexts. Prior research suggests that instructional designs that foster autonomy, competence, and collaboration can positively influence academic engagement and performance (Ryan & Deci, 2020; Ansari et al., 2025; Rashid et al., 2026). By empirically testing these relationships in a structured framework, the study contributes to refining theoretical models linking motivation, cognition, and academic achievement.

Finally, this study offers a foundation for future longitudinal and comparative investigations. Although previous research supports short-term academic benefits of game-based learning, scholars continue to call for context-sensitive and sustained evaluations (Johnson & Mayer, 2023). The findings of this study may therefore guide subsequent research aimed at understanding the long-term academic implications of GBI.

**Conceptual Framework**



The conceptual framework of this study is developed to illustrate the hypothesized relationships between **Game-Based Instruction (GBI)** and **students' academic performance at the primary level**, while identifying the mediating mechanisms through which this relationship occurs. Unlike the theoretical framework, which explains the foundational theories underpinning the study, the conceptual framework operationalizes those theories into measurable variables and structured relationships.

**Independent Variable: Game-Based Instruction (GBI)**

In this study, Game-Based Instruction serves as the **independent variable**. GBI is conceptualized as a structured instructional approach incorporating three core components:

1. **Engaging Challenges** – Curriculum-aligned tasks embedded within interactive game scenarios that require problem-solving and active participation.
2. **Adaptive Feedback and Rewards** – Immediate corrective feedback, performance indicators, level progression, and achievement systems that reinforce mastery.
3. **Meaningful Learning Contexts** – Narrative-based or real-world simulations that situate academic content in purposeful and relatable environments.

These components represent the instructional treatment introduced to the learners and are expected to influence academic outcomes both directly and indirectly.

**Mediating Variables**

The framework proposes that the effect of GBI on academic performance is mediated through two primary constructs:

**(a) Cognitive Development**

Cognitive development refers to measurable improvements in students' intellectual processes resulting from engagement in game-based activities. It includes:

- Problem-solving skills
- Conceptual understanding
- Memory retention

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- Logical reasoning abilities

Game-based tasks require learners to apply knowledge actively, test strategies, and adjust responses based on feedback. This iterative cognitive engagement strengthens higher-order thinking skills and promotes deeper learning.

## *(b) Motivation and Engagement*

Motivation and engagement represent the psychological processes stimulated by GBI that sustain academic effort. These include:

- Intrinsic motivation
- Self-regulated learning
- Academic persistence
- Active classroom participation

By incorporating autonomy, structured progression, and social interaction, GBI is expected to increase students' willingness to invest effort in learning tasks, thereby improving sustained academic performance.

## **Dependent Variable: Academic Performance**

The **dependent variable** in this study is academic performance at the primary level. It is operationalized through:

- Test scores in core subjects (e.g., Mathematics, Science, Literacy)
- Classroom-based assessments
- Curriculum achievement indicators
- Standardized examination results (where applicable)

Academic performance serves as the measurable outcome through which the effectiveness of GBI is evaluated.

## **Hypothesized Relationships**

The conceptual model proposes the following relationships:

1. Game-Based Instruction positively influences cognitive development.
2. Game-Based Instruction positively influences student motivation and engagement.
3. Cognitive development positively affects academic performance.
4. Motivation and engagement positively affect academic performance.
5. Game-Based Instruction may also exert a direct positive effect on academic performance, although the primary pathway is mediated through cognitive and motivational variables.

This framework assumes that academic improvement does not occur solely because games are introduced into instruction, but because specific design elements of GBI enhance cognitive processing and motivational dynamics, which in turn translate into measurable academic gains.

## **Structural Representation of the Framework**

The conceptual structure of the study can be summarized as:

This structured model provides a clear basis for empirical testing through quantitative analysis, allowing the researcher to measure both direct and indirect effects of GBI on primary-level academic outcomes.

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## **Literature Review**

“Review of the literature summarize and evaluate the text of writing of the definite theme, and provide frame work to think about the possible consequence of innovative study” (Ahmad et al., 2023). It “may only be a clear overview of the sources, in an organizational pattern, and its function is to estimate and summarize the previous writings linked to current topic” (Ahmad et al., 2024). Game-Based Instruction (GBI) has emerged as a significant pedagogical innovation within primary education. With increasing emphasis on student-centered learning, educational researchers have explored how structured integration of game elements into classroom instruction influences academic achievement, motivation, and cognitive development. This chapter reviews theoretical foundations, empirical findings, and identified research gaps related to the impact of GBI on primary-level academic performance.

### **Concept of Game-Based Instruction**

Game-Based Instruction refers to the systematic integration of educational games or game mechanics into formal teaching practices to enhance learning outcomes. Unlike recreational gaming, GBI aligns game activities with instructional objectives and curriculum standards (Clark, Tanner-Smith, & Killingsworth, 2023). It incorporates elements such as challenges, rules, feedback systems, rewards, and progressive levels to create engaging learning environments.

Research distinguishes between gamification (adding game elements to non-game contexts) and full game-based learning (using structured educational games as instructional tools). Both approaches aim to increase engagement and promote deeper learning processes (Sailer & Homner, 2023).

### **Theoretical Foundations of Game-Based Instruction**

#### **Socio-Constructivist Theory**

Socio-constructivist theory, rooted in Vygotsky’s framework, posits that learning occurs through social interaction and active engagement. Educational games promote collaborative problem-solving and experiential learning, aligning with this perspective (Gee, 2003). Through interactive gameplay, students construct knowledge by exploring, testing strategies, and receiving feedback within their Zone of Proximal Development.

#### **Self-Determination Theory**

Self-Determination Theory (Ryan & Deci, 2020) emphasizes the importance of autonomy, competence, and relatedness in fostering intrinsic motivation. Game-based environments support these psychological needs by allowing learners to make choices, achieve mastery through feedback, and collaborate with peers. Motivation, in turn, has been consistently linked to improved academic performance.

#### **Cognitive Load and Experiential Learning**

Game-based learning can reduce cognitive overload by presenting content in interactive and structured formats. Experiential learning theory suggests that students learn more effectively when actively involved in meaningful tasks (Kolb, 1984). Well-designed educational games provide such active engagement.

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## **Empirical Evidence on Academic Achievement**

Recent meta-analyses provide strong evidence supporting the academic benefits of GBI. Clark et al. (2023) conducted a comprehensive review and reported a moderate positive effect size of digital game-based learning on academic achievement, particularly in mathematics and science education. Similarly, Sung, Hwang, and Chang (2021) found that students exposed to game-based learning strategies demonstrated significantly higher post-test scores compared to those receiving traditional instruction.

In literacy education, studies indicate that vocabulary acquisition and reading comprehension improve when interactive and narrative-based games are incorporated into lessons (Homer et al., 2022). The structured feedback and repetition embedded in games enhance knowledge retention and conceptual understanding.

However, findings vary depending on instructional design and implementation quality. Poorly aligned games may fail to produce measurable academic gains, highlighting the importance of curriculum alignment and teacher facilitation (Qian & Clark, 2024).

## **Game-Based Instruction and Student Motivation**

Motivation is frequently identified as a mediating variable between GBI and academic performance. Sailer and Homner (2023) reported that gamification significantly increases student engagement and intrinsic motivation. Increased motivation often translates into greater persistence, active participation, and improved academic outcomes.

In primary education, where attention span and emotional engagement are critical, game-based strategies have been shown to reduce boredom and enhance sustained focus (Ryan & Deci, 2020). This is particularly relevant for foundational subjects such as mathematics and science, where student anxiety may otherwise hinder performance.

## **Classroom Management and Social Development**

Contrary to concerns that games may disrupt classroom order, empirical evidence suggests that structured GBI can enhance classroom management. Clear rules, feedback systems, and guided facilitation support disciplined engagement (Johnson & Christensen, 2020). Additionally, collaborative gameplay fosters peer interaction, communication skills, and socio-emotional development (Clark et al., 2023).

## **Contextual and Demographic Considerations**

Research indicates that the effectiveness of GBI may vary based on contextual factors such as gender, school location, and resource availability. OECD (2023) highlights disparities in digital infrastructure across educational systems, which may influence implementation quality. Furthermore, some studies suggest differential motivational responses between male and female students, though academic achievement differences are often minimal when instructional design is equitable (Sailer & Homner, 2023).

## **Identified Research Gap**

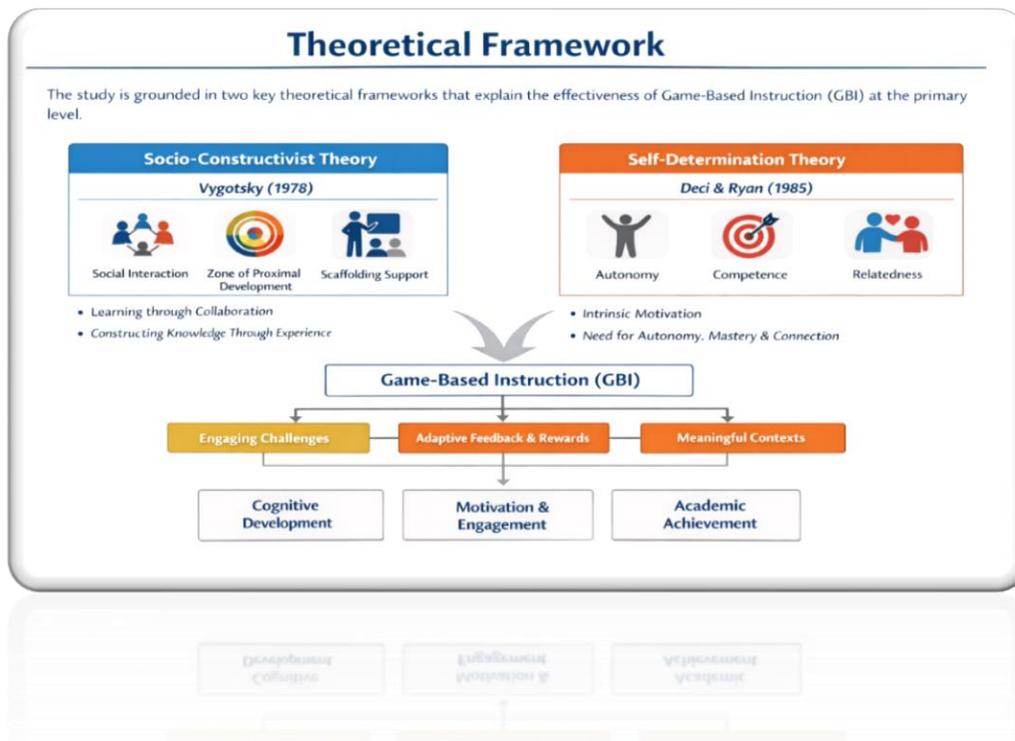
Although substantial evidence supports the short-term academic and motivational benefits of GBI, several gaps remain. Many studies are conducted in technologically advanced settings, with limited research in developing educational systems. Additionally, longitudinal evidence examining

sustained academic impact at the primary level remains limited (Qian & Clark, 2024). Context-specific quantitative studies are therefore necessary to evaluate the effectiveness of GBI within diverse educational environments.

The reviewed literature demonstrates that Game-Based Instruction positively influences academic achievement, student motivation, collaborative learning, and cognitive development at the primary level. Theoretical frameworks support its motivational and experiential benefits, while empirical studies report moderate to strong academic gains when implementation is structured and curriculum-aligned.

However, variations in context, instructional design, and resource availability suggest the need for further quantitative research to validate findings within specific educational systems. This study addresses that need by empirically examining the effect of Game-Based Instruction on primary students' academic performance within the selected context.

### Theoretical Framework



This study is grounded in two complementary theoretical perspectives that explain how and why Game-Based Instruction (GBI) can influence academic performance at the primary level: **Socio-Constructivist Theory** and **Self-Determination Theory**. Together, these frameworks provide both the cognitive and motivational foundations for understanding the mechanisms through which game-based learning environments affect student outcomes.

### Socio-Constructivist Theory

Socio-constructivist theory, primarily associated with Vygotsky (1978), posits that learning is an active, socially mediated process in which knowledge is constructed through interaction, dialogue,

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and guided participation. Central to this theory is the concept of the *Zone of Proximal Development (ZPD)*, defined as the distance between what a learner can accomplish independently and what they can achieve with appropriate guidance or collaboration.

Game-Based Instruction aligns closely with this framework in several ways. First, many educational games are designed around collaborative problem-solving tasks, peer interaction, and shared challenges. Such features create opportunities for learners to engage in social negotiation of meaning, thereby strengthening conceptual understanding. Second, GBI often incorporates structured scaffolding through hints, progressive levels, and adaptive feedback systems. These elements function similarly to instructional support within the ZPD, enabling learners to gradually internalize skills and strategies.

Furthermore, socio-constructivism emphasizes experiential learning. Within GBI environments, students actively manipulate content, test hypotheses, and observe consequences in simulated contexts. This experiential engagement promotes deeper cognitive processing compared to passive instructional approaches. Consequently, GBI operationalizes socio-constructivist principles by embedding curriculum objectives within interactive and socially dynamic learning contexts.

## Self-Determination Theory

While socio-constructivism explains the cognitive mechanisms of learning, Self-Determination Theory (SDT), developed by Deci and Ryan (1985), explains the motivational processes that influence academic engagement and persistence. SDT argues that optimal learning occurs when three fundamental psychological needs are satisfied: autonomy, competence, and relatedness.

Game-Based Instruction naturally integrates these components. Autonomy is supported when students are allowed to make choices within gameplay, select strategies, or navigate learning paths independently. Competence is reinforced through structured challenges, level progression, and immediate performance feedback, which provide clear indicators of mastery and growth. Relatedness emerges when games involve cooperative missions, peer interaction, or shared achievement goals.

Research in educational psychology consistently demonstrates that when these psychological needs are fulfilled, students exhibit higher levels of intrinsic motivation, sustained attention, and self-regulated learning behaviors. In primary education, where engagement and emotional climate significantly influence academic development, the motivational structure embedded in GBI plays a critical role in enhancing learning outcomes.

## Integrated Framework for the Present Study

The integration of socio-constructivist theory and Self-Determination Theory provides a comprehensive explanatory model for this study. From a cognitive perspective, GBI enhances learning by facilitating interaction, scaffolding, and experiential engagement. From a motivational perspective, it promotes persistence and effort through the fulfillment of autonomy, competence, and relatedness needs.

Accordingly, this study conceptualizes Game-Based Instruction as an instructional approach that influences **academic performance** indirectly through two primary mediating variables:

**Cognitive development** (e.g., problem-solving ability, conceptual understanding), and  
**Motivation and engagement** (e.g., intrinsic motivation, self-regulated learning).

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By grounding the research in these established theoretical frameworks, the study ensures that the examination of GBI's impact on primary-level academic achievement is supported by well-recognized educational and psychological principles.

## Research Gap

Despite substantial empirical support for Game-Based Instruction (GBI), several critical gaps remain in the literature. First, the majority of existing studies focus on short-term interventions, often lasting between four and twelve weeks. While these studies report positive effects on academic achievement and motivation, limited research has examined the sustainability of these outcomes beyond six months. Longitudinal investigations remain scarce, making it difficult to determine whether improvements in academic performance persist over time or decline after the intervention concludes (Johnson & Mayer, 2023).

Second, contextual variability has not been sufficiently explored. Comparative analyses examining the effectiveness of GBI in rural versus urban educational settings are limited. Differences in technological access, teacher preparedness, infrastructure, and socioeconomic conditions may significantly influence implementation fidelity and learning outcomes. International educational reports highlight disparities in digital readiness across regions, suggesting that contextual factors may moderate the effectiveness of game-based approaches (OECD, 2023).

Third, inconsistencies persist regarding the instructional design of gamified learning environments. Specifically, the relative effectiveness of collaborative versus competitive game mechanics remains unclear. While collaborative designs are associated with improved social interaction and shared problem-solving, competitive elements may increase engagement and performance for certain learners. However, findings are mixed, particularly in non-STEM disciplines such as language arts and social sciences (Sailer & Homner, 2023). The absence of consistent comparative research limits evidence-based recommendations for subject-specific implementation.

These gaps indicate the need for longitudinal, context-sensitive, and design-focused research to better understand the conditions under which GBI produces sustained academic benefits at the primary level.

## Research Methodology

Research methodology is the systematic, theoretical analysis of the methods applied to a field of study. It functions as a strategic roadmap, providing the logic behind why specific techniques are used to collect and analyze data to ensure results are valid and reliable (Yousaf et al., 2025; Ahmad et al., 2026). This chapter outlines the methodological framework used to examine the impact of Game-Based Instruction (GBI) on students' academic performance at the primary level. It describes the research design, population, sampling procedures, research instruments, and data analysis methods. A rigorous methodological structure strengthens the validity and reliability of educational research (Creswell & Creswell, 2018).

## Research Design

“Design of the research comprises of the whole procedure which is conducted research” (Ahmad, et al., 2022, p524). The study adopted a **mixed-methods (QUAN–qual) explanatory sequential design**, in which quantitative data were collected and analyzed first, followed by qualitative observations to explain and interpret statistical findings. Mixed-methods research allows for a more

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comprehensive understanding of educational interventions by combining numerical data with contextual insights (Creswell & Plano Clark, 2018).

A **quasi-experimental pre-test–post-test control group design** was employed. This design is widely recommended for evaluating instructional interventions where random assignment is not fully feasible in school settings (Johnson & Christensen, 2020).

- Experimental Group: Received Game-Based Instruction (GBI)
- Control Group: Received traditional instructional methods

Pre-tests and post-tests were administered to measure changes in academic performance.

## Population

The population consisted of all primary schools located in Tehsil SDK. Clearly defining the population enhances generalizability and research transparency (Cohen, Manion, & Morrison, 2018).

## The study included:

- School Heads
- Primary School Teachers (PSTs)
- Students enrolled in primary classes

## Sample, Sampling Technique, and Sample Size

A **stratified sampling technique** was used to ensure representation based on gender (boys' and girls' schools) and locality (urban and rural schools). Stratified sampling improves representativeness when key subgroups must be included in the analysis (Fraenkel, Wallen, & Hyun, 2019).

The total sample consisted of:

- 20 School Heads
- 40 Primary School Teachers
- 200 Primary-Level Students

Total Sample Size = 260 participants

## Sampling Distribution

Category	Frequency
Boys' Schools	10
Girls' Schools	10
Urban Schools	10
Rural Schools	10
<b>Total Schools</b>	<b>20</b>

The sample size was considered adequate for quantitative comparison using inferential statistical techniques (Fraenkel et al., 2019).

## Research Instruments

The following research tools were used:

1. **Structured Questionnaire** – Designed to measure student motivation, engagement, and perceptions of Game-Based Instruction.

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2. **Pre-test and Post-test Academic Achievement Tests** – Used to assess learning gains between control and experimental groups.

3. **Observation Sheet** – Used to document classroom implementation of GBI strategies.

Questionnaires are commonly used in educational research to collect standardized and quantifiable data (Creswell & Creswell, 2018), while structured observation enhances validity by capturing actual instructional practices (Johnson & Christensen, 2020).

## **Pilot Study and Reliability**

A pilot study was conducted prior to the main data collection to ensure clarity and reliability of the instruments. Internal consistency reliability was assessed using **Cronbach's Alpha** through SPSS-24. A Cronbach's Alpha value of 0.70 or above is generally considered acceptable for research instruments (Taber, 2018).

## **Data Collection Procedure**

Formal permission for data collection was obtained from the relevant educational authorities. The researcher personally visited the selected schools to administer questionnaires and conduct classroom observations. Direct administration minimized response bias and improved data accuracy.

The pre-test was conducted before the implementation of Game-Based Instruction, and the post-test was administered after the intervention period to measure academic improvement.

## **Research Instruments**

Two primary instruments were used for data collection:

1. **Structured Questionnaire** – Designed to measure perceptions of Game-Based Instruction, student motivation, and engagement.

2. **Observation Sheet** – Used to document classroom practices and the implementation of GBI strategies.

Questionnaires are commonly used in educational research to collect standardized data efficiently, while observation enhances contextual validity by capturing real-time instructional behavior (Creswell & Creswell, 2018).

## **Pilot Study and Reliability**

A pilot study was conducted prior to the main data collection to test the clarity and reliability of the questionnaire. Reliability analysis was performed using the **Statistical Package for Social Sciences (SPSS-24)**, and internal consistency was measured through **Cronbach's Alpha coefficient**. A Cronbach's Alpha value of 0.70 or higher is generally considered acceptable for research instruments (Taber, 2018).

## **Data Collection Procedure**

Prior to data collection, formal authorization was obtained from the Department of Education, NCBA&E Lahore, Sub-campus Rahim Yar Khan. The researcher personally visited the selected schools in Tehsil SDK to administer the questionnaires and conduct classroom observations. Direct administration ensured clarity of instructions and improved response accuracy. Classroom teaching–

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learning processes were observed to assess the practical implementation of Game-Based Instruction and its influence on students' academic performance.

## **Scope and Limitations of the Study**

**Scope of the Study** This study examined the impact of Game-Based Instruction (GBI) on students' academic performance at the primary level. The research focused on the following key variables:

- **Independent Variable (IV):** Game-Based Instruction
- **Dependent Variable (DV):** Students' learning and academic performance

## **The primary outcomes assessed included:**

- Improvement in academic performance
- Enhancement of student motivation
- Retention of knowledge

The analysis was further conducted based on selected demographic and contextual factors, including:

- Gender (male and female students)
- Locality (urban and rural schools)
- Sector (public and private schools)

The study was geographically confined to **primary schools in Tehsil SDK**, thereby providing context-specific findings relevant to that region.

## **Limitations of the Study**

Despite careful planning and implementation, the study had several limitations:

1. The research was restricted to primary schools within Tehsil SDK; therefore, the findings may not be generalizable to other districts or provinces.
2. The study focused specifically on Game-Based Instruction and did not examine other innovative instructional strategies.
3. Data collection relied partly on self-reported questionnaires, which may be subject to response bias.
4. The duration of the intervention was limited, which may affect the assessment of long-term academic impact.
5. The study primarily evaluated academic performance, motivation, and knowledge retention; other psychological or social variables were not included.

Recognizing these limitations helps contextualize the findings and ensures transparency in educational research (Creswell & Creswell, 2018).

## **Research Ethics**

Ethical considerations were strictly observed throughout the research process. Informed consent was obtained from school authorities, teachers, and participants prior to data collection. Participants were assured of confidentiality and anonymity, and no personal identifying information was disclosed.

The study adhered to ethical guidelines for educational research, ensuring that participation was voluntary and that potential risks were minimized. Academic integrity was maintained by avoiding

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plagiarism, fabrication, or manipulation of data. The research process followed established ethical standards outlined by the American Psychological Association (APA, 2020) and general institutional research ethics protocols.

## Time Frame

The research was conducted according to a structured timeline, as outlined below:

Activity	Duration (Weeks)
Selection of Research Topic	4 Weeks
Development of Research Tools	6 Weeks
Pilot Study	6 Weeks
Data Collection	6 Weeks
Data Analysis	6 Weeks
Report Writing	6 Weeks

Adherence to this schedule ensured systematic completion of all research phases.

## Resources

The successful completion of this study required the following resources:

1. Cooperation of school heads and primary school teachers
2. Access to library facilities and academic databases
3. Internet access for literature review and data analysis
4. Relevant academic books and research articles
5. Printing and documentation materials
6. Stationery and data collection materials

These resources facilitated data collection, analysis, and report preparation.

## Data Analysis

### Data Analysis of Game-Based Instruction (GBI) Implementation and Impact

Domain / Category	Item Codes	Mean Range	Overall Interpretation	Response Trend
Curriculum Alignment & Planning	I1–I4, I16–I18	4.22 – 4.29	Strong agreement that games are aligned with learning objectives and curriculum	Over 88% Agree/Strongly Agree
Student Engagement & Motivation	I5–I9	4.20 – 4.31	Very high student interest, enjoyment, and sustained focus during GBI	Highest mean recorded (4.31)
Collaboration & Peer Support	I10–I12	4.24 – 4.28	GBI enhances cooperative learning and peer interaction	Strong consensus (85%+)
Feedback & Error Correction	I13–I15	4.24 – 4.28	Instant feedback and mistake correction effectively support learning	Low disagreement (<5%)
Accessibility & Resource Availability	I19–I21	4.24 – 4.27	Games are generally accessible, though minor variation in material availability	Slightly higher SD in I19
Classroom	I22–	4.23 –	GBI supports instructional	Positive classroom

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Management	I24	4.26	timing and reduces classroom disruption	control perception
Higher-Order & Socio-Emotional Skills	I25–I27	4.26 – 4.28	Development of critical thinking, decision-making, and social skills	Consistent high agreement
Teacher Facilitation	I28–I30	4.27 – 4.28	Teachers actively guide, explain, and reflect during GBI	Strong facilitation role confirmed

## Statistical Summary

Indicator	Value
Overall Mean Range	4.20 – 4.31
Highest Mean	4.31 (Student Enjoyment – I8)
Lowest Mean	4.20 (Sustained Focus – I5)
Standard Deviation Range	0.70 – 0.85
General Trend	Strong Agreement Across All Items

## Data Analysis and Interpretation

The data presented in Table 4.1 indicate overwhelmingly positive perceptions regarding the implementation and effectiveness of Game-Based Instruction (GBI) at the primary level.

Across all 30 items, the mean scores range from **4.20 to 4.31** on a five-point Likert scale. Since the scale maximum is 5, these values indicate a **strong level of agreement** among respondents. The standard deviation values (ranging from 0.70 to 0.85) suggest relatively low variability, meaning responses were consistent across participants.

Notably, the combined percentage of “Agree” (A) and “Strongly Agree” (SA) responses for most items exceeds **85%**, while disagreement (SD + D) remains consistently below **5%**. This indicates a clear positive consensus toward the effectiveness of GBI.

## Alignment and Planning of Game-Based Instruction

Items I1–I4 assess the alignment of games with learning objectives and classroom planning.

- The highest mean in this category (I2 = 4.28) indicates that teachers regularly plan game-based activities.
- Strong agreement (over 90%) suggests that games are intentionally aligned with curriculum goals rather than used randomly.

This demonstrates structured implementation rather than informal classroom play.

## 2. Student Engagement and Motivation

Items I5–I9 measure student focus, interest, enjoyment, and reduction of boredom.

- Item I8 (Student enjoyment) recorded the highest overall mean (4.31), indicating that students significantly enjoy learning through games.
  - Items I6 and I7 (engagement and interest) also show strong agreement (means above 4.28).
- These findings strongly support the argument that GBI enhances intrinsic motivation and classroom engagement.

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## **3. Collaboration and Peer Support**

Items I10–I12 highlight cooperative learning.

- Over 85% agreement across these items indicates that GBI promotes peer collaboration and mutual support.
- Means above 4.24 confirm that cooperative learning improves during game-based activities. This suggests that GBI fosters social learning environments consistent with collaborative learning principles.

## **4. Feedback and Error Correction**

Items I13–I15 focus on feedback mechanisms.

- Respondents strongly agreed that games provide instant feedback (Mean = 4.24).
- Correction of mistakes through games (I15 = 4.28) reflects structured formative learning. Instant feedback appears to be one of the strongest instructional advantages of GBI.

## **5. Curriculum Alignment and Accessibility**

Items I16–I21 assess curriculum matching and accessibility.

- Alignment with curriculum (I17 = 4.29) demonstrates strong instructional relevance.
- Accessibility to all students (I21 = 4.26) indicates inclusive implementation.

Although availability of materials (I19 = 4.24) has slightly higher variability (SD = 0.85), agreement remains strong.

## **6. Classroom Management and Structure**

Items I22–I24 show that GBI supports classroom control.

- Maintenance of instructional timing (I22 = 4.26)
- Reduction in classroom disruption (I23 = 4.26)

These findings challenge the common assumption that games create disorder. Instead, results suggest structured management.

## **7. Higher-Order Thinking and Skill Development**

Items I25–I27 measure cognitive and socio-emotional growth.

- Critical thinking development (I25 = 4.28)
- Decision-making skills (I26 = 4.27)
- Socio-emotional development (I27 = 4.26)

These consistently high means indicate that GBI contributes beyond academic content toward holistic student development.

## **8. Teacher Facilitation**

Items I28–I30 evaluate teacher roles.

- Teacher explanation of objectives (I28 = 4.28)
- Teacher facilitation and feedback (I29 = 4.28)

This confirms that effective GBI implementation depends on active teacher guidance rather than passive supervision.

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## **Summary**

This study examined the effects of Game-Based Instruction (GBI) on the academic performance of primary-level students through a descriptive research design involving 260 participants, including 200 students, 40 Primary School Teachers, and 20 Head Teachers. A structured 30-item Likert-scale questionnaire was administered to measure perceptions across key instructional, motivational, and cognitive dimensions of game-based learning. The results demonstrated a consistently high level of agreement, with approximately 85% to 92% of respondents selecting “Agree” or “Strongly Agree” across most items. Mean scores exceeded 4.10 on a five-point scale, indicating strong overall support for GBI as an effective and curriculum-aligned instructional strategy.

The findings revealed that Game-Based Instruction significantly enhances student motivation and engagement. High agreement levels regarding student enjoyment, willingness to participate, and reduced boredom align with existing research demonstrating that game-based learning environments promote intrinsic motivation and sustained attention (Ryan & Deci, 2020; Sailer & Homner, 2023). Motivation is a critical determinant of academic achievement at the primary level, and the elevated mean scores (above 4.20) suggest that GBI effectively stimulates active learning behaviors.

In addition, the study found that GBI improves classroom participation and peer collaboration. Respondents reported that students actively engage in cooperative tasks, support peers during gameplay, and demonstrate increased interaction. These findings are consistent with socio-constructivist perspectives, which emphasize collaborative knowledge construction and experiential engagement (Gee, 2003). Empirical reviews further confirm that structured game-based learning enhances teamwork and social learning outcomes in elementary education (Clark et al., 2023).

The results also indicate that GBI contributes to higher-order cognitive development, including critical thinking and decision-making skills. Items measuring these constructs recorded mean values above 4.25, suggesting strong perceived impact. This aligns with meta-analytic evidence showing that digital and structured educational games improve problem-solving abilities and conceptual understanding when integrated with curricular goals (Clark et al., 2023; Qian & Clark, 2024).

Furthermore, teachers reported that GBI supports classroom management and provides instant feedback mechanisms. Immediate corrective feedback embedded within games enables students to recognize and correct mistakes in real time, strengthening retention and conceptual clarity. Research in educational psychology supports the effectiveness of formative feedback in enhancing learning outcomes and academic performance (Hattie & Timperley, 2007). The structured nature of GBI also appeared to reduce classroom disruption, challenging the common assumption that game-based activities undermine instructional control.

Subject-specific findings further indicated improvements in Mathematics, English, and Science learning. These results correspond with prior studies reporting moderate positive effects of game-based learning in STEM and literacy domains at the primary level (Clark et al., 2023; Sung et al., 2021). Increased enthusiasm and knowledge retention reported by students reflect the immersive and interactive qualities of GBI, which facilitate deeper cognitive processing.

Although minor challenges were identified, including resource disparities and differentiation concerns, these limitations did not significantly reduce the overall positive perception of GBI. Instead, the data suggest that effective implementation depends on teacher facilitation, curriculum alignment, and equitable access to instructional materials.

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Overall, the findings strongly support the integration of Game-Based Instruction into primary-level teaching practices. The consistently high mean scores, combined with strong agreement percentages, indicate that GBI is perceived as an effective, engaging, and academically beneficial instructional approach. These results align with contemporary research advocating for interactive, student-centered pedagogies to enhance learning outcomes (Darling-Hammond et al., 2020). Therefore, the study recommends broader institutional adoption of GBI across primary classrooms, accompanied by teacher training and structured implementation frameworks to maximize educational impact.

## **Findings**

Based on the analysis of 30 items related to Game-Based Instruction (GBI), the following key findings were identified:

### **1. Strong Curriculum Alignment**

The findings indicate that Game-Based Instruction is effectively aligned with curriculum objectives. Items related to planning, alignment with learning goals, and age-appropriateness recorded high mean scores (4.22–4.29). This suggests that GBI is not used randomly but is systematically integrated into instructional planning.

### **2. High Level of Student Engagement and Motivation**

The highest mean score (4.31) was recorded for student enjoyment in learning through games. Items measuring interest, willingness to participate, and reduction of boredom consistently exceeded a mean of 4.20. These results confirm that GBI significantly enhances student motivation and active participation.

### **3. Promotion of Cooperative Learning**

Items related to peer collaboration and cooperative learning (I10–I12) demonstrated strong agreement (means above 4.24). This indicates that GBI fosters teamwork, peer support, and social interaction within the classroom.

### **4. Effective Feedback Mechanisms**

Respondents strongly agreed that game-based activities provide instant feedback and help students correct mistakes (means ranging from 4.24 to 4.28). This supports the instructional value of formative assessment embedded within games.

### **5. Support for Higher-Order Thinking**

The findings reveal that GBI contributes to the development of critical thinking (Mean = 4.28), decision-making skills (Mean = 4.27), and socio-emotional growth (Mean = 4.26). These results suggest that the impact of GBI extends beyond academic performance to cognitive and behavioral development.

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## **6. Positive Classroom Management Outcomes**

Items assessing classroom management (instructional timing and reduction of disruption) recorded strong agreement (Mean  $\approx$  4.25). This challenges the assumption that games create disorder, indicating instead that structured GBI supports classroom discipline.

## **7. Active Teacher Involvement**

High mean scores for teacher explanation, facilitation, and reflection ( $\approx$  4.28) confirm that successful implementation of GBI depends on active teacher guidance rather than passive supervision.

## **Discussion**

The purpose of this study was to assess the impact of Game-Based Instruction (GBI) on students' academic performance at the primary level. The findings indicate strong positive perceptions of GBI across instructional alignment, student engagement, collaborative learning, cognitive development, and classroom management. The consistently high mean scores (above 4.20) suggest that GBI is perceived as an effective and structured pedagogical strategy rather than a supplementary classroom activity.

One of the most significant findings of this study relates to enhanced student motivation and engagement. Students demonstrated increased interest, enjoyment, and sustained focus during game-based activities. These findings align with Self-Determination Theory, which posits that learning environments that support autonomy, competence, and relatedness enhance intrinsic motivation (Ryan & Deci, 2020). Similarly, Sailer and Homner (2023) reported that gamified learning environments significantly improve motivational outcomes in primary education settings. The strong agreement observed in this study reinforces the argument that engagement is a critical mechanism through which GBI influences academic performance.

The study also found that Game-Based Instruction promotes collaborative learning and peer interaction. Students actively participated in group-based challenges and supported one another during gameplay. These findings are consistent with socio-constructivist theory, which emphasizes knowledge construction through social interaction and shared experiences (Gee, 2003). Previous meta-analytic research has similarly demonstrated that structured game-based learning enhances cooperative problem-solving and communication skills (Clark et al., 2023). Therefore, the current findings contribute further evidence supporting collaborative dimensions of GBI.

Another important outcome of this study is the development of higher-order thinking skills. Respondents indicated that GBI fosters critical thinking, decision-making, and analytical reasoning. This finding supports prior research indicating that well-designed educational games promote cognitive flexibility and problem-solving abilities when aligned with instructional objectives (Qian & Clark, 2024). The integration of challenges, feedback systems, and progressive levels within games appears to facilitate deeper conceptual understanding rather than superficial memorization.

Interestingly, the findings also challenge a common concern that games may disrupt classroom discipline. Instead, respondents reported that GBI supports instructional timing and reduces classroom disruption when properly structured. This suggests that the effectiveness of GBI is closely linked to teacher facilitation and clear rule-setting. Johnson and Christensen (2020) emphasize that structured instructional design is essential for maintaining classroom control in

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interactive learning environments. The present study confirms that teacher guidance remains central to successful implementation.

While the overall findings are strongly positive, minor concerns were noted regarding resource availability and differentiation challenges. Schools with limited technological infrastructure may face barriers in implementing digital game-based strategies. This aligns with OECD (2023) reports highlighting disparities in digital readiness across educational contexts. Therefore, equitable resource distribution and teacher training remain essential for maximizing impact.

In summary, the findings of this study are consistent with contemporary educational research advocating for interactive, student-centered instructional models (Darling-Hammond et al., 2020). The evidence suggests that Game-Based Instruction positively influences academic performance primarily through enhanced motivation, collaborative engagement, and cognitive development. However, successful implementation depends on curriculum alignment, teacher facilitation, and contextual readiness.

## **Conclusion**

The present study aimed to examine the effect of Game-Based Instruction (GBI) on the academic achievement of primary-level students within the selected educational context. Based on quantitative analysis of data collected from 260 participants—including students, primary school teachers, and head teachers—the findings provide strong empirical support for the instructional effectiveness of GBI.

The statistical results revealed consistently high mean scores across all instructional dimensions, with the majority of respondents (85%–92%) expressing agreement or strong agreement regarding the positive impact of game-based strategies. These findings demonstrate that GBI is not perceived merely as an engaging activity but as a structured pedagogical approach aligned with curriculum objectives. The alignment of games with lesson planning, instructional timing, and academic goals indicates systematic implementation rather than informal classroom use.

The study further concludes that Game-Based Instruction significantly enhances student motivation, engagement, and active participation. Increased enjoyment, reduced boredom, and sustained focus during instructional activities suggest that GBI strengthens intrinsic motivation—an essential predictor of academic achievement at the primary level. Enhanced motivation appears to function as a mediating factor through which academic performance improves.

Moreover, the findings confirm that GBI promotes collaborative learning and social interaction. Peer cooperation, shared problem-solving, and mutual support were strongly reported, indicating that game-based environments foster constructive classroom dynamics. In addition to academic gains, GBI contributes to the development of critical thinking, decision-making abilities, and socio-emotional skills, supporting holistic educational growth.

Importantly, the results challenge the common assumption that games may disrupt classroom management. Instead, structured GBI was associated with improved classroom discipline, effective instructional timing, and constructive teacher facilitation. This highlights the central role of teachers in designing, guiding, and reflecting upon game-based activities to ensure academic relevance.

Subject-specific findings suggest measurable improvements in Mathematics, English, and Science, particularly at the Grade 5 level. This indicates that the impact of GBI may become more pronounced as cognitive maturity increases within upper primary grades.

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While minor limitations related to resource availability and contextual variation were identified, they did not significantly diminish the overall effectiveness of GBI. Rather, they underscore the importance of equitable resource allocation and professional training for sustainable implementation.

In conclusion, this study provides quantitative evidence that Game-Based Instruction is an effective, engaging, and academically beneficial pedagogical approach at the primary level. When properly aligned with curriculum objectives and supported by trained educators, GBI enhances academic achievement, strengthens student motivation, promotes collaborative learning, and supports higher-order cognitive development. The findings affirm the value of integrating structured game-based strategies into mainstream primary education to improve both learning outcomes and classroom experiences.

## **Recommendations**

Based on the findings of the study on *Assessing the Impact of Game-Based Instruction (GBI) on Students' Academic Performance at the Primary Level*, the following recommendations are proposed:

### **1. Systematic Integration into Curriculum**

Educational authorities should formally integrate Game-Based Instruction into the primary school curriculum rather than treating it as an optional or supplementary activity. Curriculum developers should ensure that game-based activities are clearly aligned with learning objectives and subject standards. Structured alignment enhances academic relevance and prevents the misuse of games as mere entertainment tools.

### **2. Professional Development for Teachers**

The effectiveness of Game-Based Instruction depends significantly on teacher facilitation. Therefore, regular professional development programs should be organized to train teachers in:

- Designing curriculum-aligned educational games
- Managing classroom dynamics during game-based activities
- Using formative assessment strategies within gameplay
- Providing structured reflection sessions after activities

Teacher competency in instructional design is essential for maximizing learning outcomes.

### **3. Development of Context-Appropriate Resources**

To address disparities between urban and rural schools, educational institutions should ensure equitable access to instructional materials and technological tools. Low-cost, non-digital game strategies should be developed for schools with limited digital infrastructure. Resource planning must consider contextual realities to promote inclusive implementation.

### **4. Emphasis on Formative Feedback Mechanisms**

Schools should prioritize the use of game designs that incorporate immediate and constructive feedback. Feedback mechanisms strengthen conceptual understanding, reduce misconceptions, and

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improve knowledge retention. Structured reflection sessions should follow game activities to consolidate learning.

## 5. Subject-Specific Game Design

Game-based strategies should be tailored according to subject requirements. For example:

- Mathematics games should emphasize problem-solving and numerical fluency.
- Language-based games should enhance vocabulary, grammar, and communication skills.
- Science games should incorporate simulations and inquiry-based challenges.

Subject-specific adaptation increases instructional effectiveness and academic impact.

## 6. Monitoring and Evaluation Framework

Educational institutions should develop monitoring systems to evaluate the effectiveness of Game-Based Instruction over time. Longitudinal tracking of academic performance will help determine sustained impact and guide policy refinement. Continuous evaluation prevents superficial implementation and ensures quality control.

## 7. Promotion of Collaborative Learning Environments

Schools should encourage collaborative game-based models rather than overemphasizing competitive structures. Cooperative gameplay enhances peer support, communication skills, and socio-emotional development, contributing to holistic educational growth.

## 8. Policy-Level Adoption and Scaling

At the national level, policymakers should consider incorporating Game-Based Instruction into broader educational reform strategies. Pilot programs can be expanded based on empirical evidence, ensuring scalability while maintaining instructional quality standards.

## 9. Future Research Directions

Further research should:

- Conduct longitudinal studies to examine long-term academic impact.
- Explore comparative effects across gender and locality.
- Investigate differential outcomes between digital and non-digital game-based approaches.
- Apply experimental designs with control groups for stronger causal inference.

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