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An Empirical Analysis of Conventional and Game Based Pedagogical Approaches on Learner Motivation and Engagement

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Abstract

Despite India's pressing educational deficits, with over 25% of adolescents lacking basic literacy and numeracy, empirical studies on instructional effectiveness remain limited. This study evaluates how game-based learning (GBL) and conventional pedagogies influence motivation and engagement among Indian students. By isolating their differential impacts, the research aims to inform scalable, evidence-based strategies for improving science learning outcomes in resource-constrained classrooms. The findings are positioned to advance both academic literature and policy dialogue on pedagogical reform in non-Western, digitally evolving education systems. Employing a purposive sampling methodology across 93 government schools, the study analyzed 1,816 valid participants aged 13-18 years following systematic exclusion criteria. Data collection utilized linguistically adapted, psychometrically validated instruments including the Student Motivation Scale and Student Engagement Instrument, alongside custom-developed conventional and game-based learning preference assessments. Statistical analyses revealed robust positive correlations between game-based learning preferences and both student motivation ($r = 0.67$, $p < 0.001$) and engagement ($r = 0.71$, $p < 0.001$). Multiple regression models demonstrated that GBL preferences accounted for 45% of variance in motivation ($R^2 = 0.45$) and 50% of variance in engagement ($R^2 = 0.50$), with standardized beta coefficients of 0.67 and 0.70 respectively. Conversely, conventional learning preferences showed negligible correlations with motivational outcomes ($r = -0.02$, $p= 0.36$). Significant age-related patterns emerged, with younger adolescents (13-15 years) demonstrating substantially higher GBL preferences and motivation levels compared to older peers. These findings provide compelling empirical support for integrating game-based pedagogical strategies in under-resourced educational environments.

Keywords: *Gamification; Engagement; Learning; Motivation; Conventional Learning; Education; Game Based Learning*

1. Introduction

The rapid rise and development of pedagogical approaches in the twenty-first century has intensified scholarly interest into the mechanisms underlying student engagement and motivation, particularly as they underscore the efficacy of gamified and conventional pedagogical approaches. Due to a persistent lack of access to educational resources and equity in South Asia, the enduring problem of a dismal state of science education has emerged. In an effort to meaningfully address the critical gap in scholarly literature and advance academic inquiry, this study seeks to critically analyze the variations in student engagement and motivation across game-based, and conventional fields.

Within global education systems, South Asia—home to over 2 billion people (World Bank, 2025)—is distinguished from the rest of the world by its lower developmental levels. As a region with predominantly agricultural livelihoods, it faces greater challenges in terms of access and equity, low per capita income, and public service deficits. Schools frequently lack access to electricity, proper sanitation, and an adequate supply of academically qualified teachers to teach students. This study focuses on student perceptions within under-resourced regions of the Republic of India, where systemic challenges continue to hinder learning outcomes. The state of science education in India faces significant challenges, with 25% of youth aged 14-18 unable to read Grade 2 level texts in their regional language (ASER Center, 2024) and over 50% struggling with Grade 5 arithmetic skills (ASER Center, 2022). These foundational deficiencies in numeracy and literacy hinder science learning and underscore the need for scholarly research and pedagogical innovation.

Analyzing the impact of conventional pedagogical approaches and game-based pedagogical approaches on student motivation and cognitive engagement in environments can provide invaluable insights into addressing these issues. This research aims to advance the quantitative and empirical understanding of learning processes and outcomes, thereby supporting the development of evidence-based interventions to improve educational equity. Furthermore, by examining the differential effects of gamified and conventional learning approaches, this study seeks to inform policy, teacher practices, and future educational research in the Republic of India.

1.1 Motivation & Learning

As Peters (2015) notes, motivation is a fundamental biological principle that governs human decision making. Rabey (2001) further characterized it as a composition of internal factors that initiate, direct, and sustain goal-oriented behavior (Sekhar et al., 2013). Motivation is as integral to human action as utility in economics or recursion in computer science, serving as the driving force behind purposeful activity (Park, 2017).

Classic theories of motivation elaborate on the drivers of motivation and the specific constructs that push and sustain intrinsic (genuine) motivation. Drivers are classified into two distinct categories: innate and cognitive. Innate drives are intrinsic, evolutionarily based motivators that have developed over millions of years of human evolution. These drivers are inherent, built-in, and biologically encoded by natural selection. Examples of such innate drivers include instincts, drives, and fight-or-flight responses. (Frey, 1992; Reiss, 2012; Morris et al., 2022). On the other hand, cognitive drives are developed drivers that form through lived experiences; beliefs, values, and self-perceptions are cognitive drivers.

Both drivers are essential for shaping the concept of motivation. Cognitive motivation—based on attribution theory, expectancy-value theory, and self-efficacy theory—highlights that learners must understand and appreciate their activities to be motivated (Piaget, 1964). Furthermore, cognitive motivation theories, such as Self-Determination Theory (SDT), suggest that motivation is fostered when individuals experience autonomy and freedom, thus emphasizing the importance of a student's sense of control while learning. Building on this, Achievement Goal Theory (AGT) further categorizes learners based on their mastery or performance goals (Ciani et al., 2011; Lakerveld et al., 2020). AGT reveals the diverse motivational profiles that students bring to educational settings (Ozdemir Oz, Lane, & Michou, 2016).

These theoretical frameworks underscore the multidimensionality of motivation and how the two-fold drivers of motivation simultaneously contribute to long-term, sustained motivation. Furthermore, these frameworks illustrate that in addition to the two-drivers, long-term motivation is regulated by the coordinated action of psychological, physiological, and environmental factors—all of which are integrated through complex neural process to drive learning—thus highlight the inter-linked relation of motivation and learning (Standage et al., 2003; Kim, S. I., 2013; Schunk & Usher el al., 2012; Michou et al., 2016)

1.2 Multidimensionality of Learning

Similar to, motivation, learning has a multidimensional nature. Learning is the process of acquiring, comprehending, and processing information (Ryan & Deci, 2000). Unlike motivation, learning is inherently progressive and necessitates sustained input and adaptation (Pan, 2023). With the intent to contribute to the limited literature, this analysis aims to advance a rigorous definition of learning as a distinct yet interrelated construct of motivation.

The concept of learning is foundational yet contested in pedagogical discussions, educational psychology, and cognitive science. At its core, learning has traditionally been defined as a relatively permanent change in behavior or knowledge that results from experience (De Houwer, Barnes-Holmes, & Moors, 2013; Domjan, 2013; Ormrod, 2008). However, this basic functional definition—mapping experience onto behavior—has been critiqued for its over-inclusiveness, as it may encompass any behavioral change, regardless of whether it is truly the result of structured learning or simply a reaction to a singular environmental stimulus (De Houwer et al., 2013; Lachman, 1997; Bransford & National Research Council, 2004).

Consider a scenario in which an individual touches a hot stove and instinctively withdraws their hand in response to the resulting pain. This subsequent avoidance behavior (i.e., opting not to touch the stove again) emerges directly from the prior aversive experience. While this scenario may appear to reflect a “learning process” in the context of the prior definition, it is more accurately characterized as a reflexive or conditioned response to an aversive stimulus, rather than deliberate or structured learning. In contrast, the process of systematically acquiring culinary skills—such as mastering techniques, internalizing procedural knowledge, and retaining recipes over time—constitutes a more structured and intentional form of learning that is indicative of cognitive engagement (Chang, Hsu, Cheng, & Kuo, 2019).

De Houwer et al. (2013) offer a more rigorous conceptualization, stating that learning should be understood as “ontogenetic adaptation.” Ontogenetic adaptations are changes in an organism’s behavior resulting from regularities in the environment. This definition purposefully excludes one-off behavioral changes, focusing instead on long-term transformations that arise from consistent patterns of experiences. This perspective aligns with the view that learning is not merely the product of exposure and distinguishes learning from mere performance or reflexive adaptation (Hall, 2003; Ormrod, 2008).

Importantly, learning is not a monolithic concept. Rather, it is a multidimensional construct that encompasses cognitive, affective, and behavioral domains (Bloom, 1956; Krathwohl, Bloom, & Masia, 1964). This three-tiered framework remains influential in both empirical research and educational practice. Moving forward, this study encompasses the three most prominent forms of learning: cognitive, affective, and behavioral.

Cognitive learning involves the acquisition, organization, and application of knowledge-based intellectual skills. It includes processes such as perception, memory, reasoning, and problem-solving (Simon, 1998; Skinner, 1965; Anderson et al., 2011). Cognitive learning theories are rooted in Piaget's (1964) work and further expanded by information- processing models, emphasizing the active construction of knowledge and the importance of mental representations. In contemporary research, cognitive learning is often operationalized through assessments of knowledge retention, transfer, and higher order thinking skills (Bransford, Brown, & Cocking, 2000; Mayer, 2002).

Affective learning encompasses the development of attitudes, values, motivations, and emotional responses that influence persistent engagement in learning tasks (Krathwohl et al., 1964; Pekrun, 2011). This domain is critical in educational contexts, as affective factors such as interest, self-efficacy, and emotional regulation mediate the quality and quantity of cognitive engagement (Pintrich & De Groot, 1990; Pekrun, 2011). Recent research underscores the importance of affective engagement in technology-enhanced and game-based learning environments, where emotional involvement drives sustained participation and deeper learning (Hamari et al., 2016; Plass, Homer, & Kinzer, 2015).

Behavioral learning is grounded in the principles of behaviorism (Watson, 1913). Academically referred to as "BL," behavioral learning focuses on observable changes in behavior as a result of environmental stimuli and reinforcement. This perspective has informed the development of instructional strategies such as direct instruction, feedback, and reinforcement schedules (Domjan, 2013). While behavioral outcomes are often the most readily measurable, contemporary scholars caution against equating all behavioral changes with meaningful learning, emphasizing the necessity of linking observed behaviors to underlying cognitive and affective processes (De Houwer et al., 2013; Ormrod, 2008). This assertion can be further substantiated by the previously cited example of the heated kettle.

The rapid technological and social development in the world has underscored the essentiality of lifelong learning; however, conventional classroom models have struggled to meet this emergent demand, thereby necessitating a critical analysis of student engagement and motivation within both gamified and conventional learning environments.

1.3 Measuring Learning

The measurement of learning is as multifaceted and complex as its definitions. Measuring such a construct requires a multidimensional approach, similar to that of motivation and learning assessment strategies that capture cognitive, affective, and behavioral outcomes of the students. Traditional approaches have relied on standardized tests (such as the GRE or the ACT), along with performance assessments and behavioral observations to gauge learning gains (Bransford et al., 2000; Simon, 1998). However, these methods often result in cognitive outcomes being overlooked, affecting the motivational dimensions that are increasingly recognized as integral to educational success (Pekrun, 2011; Fredricks, Blumenfeld, & Paris, 2004).

Cognitive learning is typically measured using pre- and post-tests. However, other methods, such as concept inventories, problem-solving tasks, and transfer assessments, have also been shown to evaluate the depth and flexibility of students' understanding (Mayer, 2002; Bransford et al., 2000). Advancements in educational technology have enabled the use of adaptive assessments and learning analytics to provide nuanced insights into cognitive development over time (Shute & Wang, 2016).

Affective learning is commonly assessed using self-report instruments that measure constructs such as motivation, interest, attitudes, and self-efficacy (Pintrich & De Groot, 1990; Schunk, Meece, & Pintrich, 2014). Observational protocols and qualitative methods, such as interviews and reflective journals, have also been employed to capture the richness of affective experiences in learning environments (Pekrun, 2011; Plass et al., 2015).

Behavioral learning is assessed by directly observing how tasks are performed, how often individuals participate, the rate at which tasks are completed, and the exhibition of specific skills and competencies (Domjan, 2013; Fredricks et al., 2004). In digital and game-based environments, behavioral data can be collected through log files, clickstream analysis, and in-game metrics, providing real-time evidence of engagement and skill development (Hamari et al., 2016; Plass et al., 2015).

In light of the constraints associated with relying on a single method, modern researchers support the use of comprehensive assessment techniques that integrate data from cognitive, affective, and behavioral areas (Bransford et al., 2000; Shute & Ventura, 2013). This was achieved through vector modeling. The outcome of employing such a triangulated approach is the development of authentic assessments. These assessments, which include project-based learning activities, portfolios, and simulations, are gaining recognition for their effectiveness in evaluating complex learning outcomes in real-world settings (Gulikers, Bastiaens, & Kirschner, 2004; Darling-Hammond & Snyder, 2000).

1.4 Conceptual Comparison Between Game Based Learning and Gamification

Within this theoretical landscape, the distinction between traditional and game-based learning becomes increasingly salient. As this analysis continues, it is necessary to establish the relative pedagogical advantages of gamification over Game-Based Learning (GBL). This assertion is grounded in a comparative analysis across six dimensions: 1) nature, 2) structure, 3) User Awareness, 4) Learning Environments, 5) duration, and 6) Content Focus. Game-based learning is an instructional approach that employs full-fledged games with defined rules, goals, and feedback systems to facilitate knowledge or skill acquisition. Learners engage directly in gameplay, where educational content is intrinsically integrated within the game's mechanics and narrative, promoting problem solving, critical thinking, and decision making (Gee, 2003; Kapp, 2014; Connolly et al., 2012).

However, a clear distinction must be made between GBL and gamification. The systems utilized in GBL are self- contained systems specifically designed to impart certain skills or knowledge. Hence, learners actively engage in gameplay, where educational content is directly integrated into the mechanics, narrative, and code. This means that there is a clear distinction between "inside the game" and "outside the game." Furthermore, users see a clear distinction between the two. Game-based learning follows a distinct structure: a defined beginning, gameplay phase, and conclusion. This flow (Start → Play → Stop) is fundamental to the game experience and culminates in a "win state" for users. While aiming to win, learners are consciously aware that they are engaging with a game, and the game itself becomes the primary vehicle for content delivery. Throughout this process, learners remain consciously aware of their engagement with games. The game serves as the principal medium for imparting knowledge. GBL is particularly effective in teaching complex cognitive skills, such as resource allocation, decision-making, and managing trade-offs.

This is often done within immersive and contextualized scenarios, making learning easier. GBL is commonly employed in formal, structured instructional events, typically as standalone learning experiences in either classroom or online formats (Kapp, 2014). In contrast, gamification applies select game elements—such as points, levels, achievements, badges, and leaderboards—to non-game contexts (Deterding et al., 2011). There is no unified narrative or win state; instead, game mechanics are layered over existing activities to motivate users and reinforce desired behaviors (Werbach & Hunter, 2015). In terms of user awareness, GBL provides an overtly game-like experience in which learners are fully aware that they are playing a game. These experiences are often immersive and story-driven, promoting deep cognitive engagement among users. Through simulations, role-playing, and interactive scenarios, GBL supports the development of critical and system thinking (Gee, 2003; Shaffer et al., 2005). For instance, in the game Minecraft, players follow specific paths involving survival, construction, and exploration and often complete fixed tasks to earn rewards. In contrast, gamification is distinctly subtle, and learners may not always be aware that they are engaging in a "game-like" experience. Instead, they are motivated by incremental rewards and feedback mechanisms that promote continued interaction with learning content (Hamari, Koivisto, & Sarsa, 2014). Such incremental motivation is what makes gamification an excellent tool for reinforced learning; through incremental bursts of motivational stimuli, learners more easily internalize fundamental concepts, retain key information, and develop deeper cognitive associations. Explicit and immersive game-based learning experiences underscore their benefits in structured settings, such as boardrooms or workshops (Kapp, 2014). However, the self-contained nature of these games often renders them one-time events. Despite being immersive and instructional in nature, game-based learning lacks continuity, often leading to eventual boredom and a dip in additional learning. Thus, while GBL is highly effective for recreational or scenario-based instruction, it is less optimal for incremental or ongoing learning. Examples include strategy games such as SimCity, which teaches urban planning, and medical simulations used for training healthcare professionals (Connolly et al., 2012). In contrast, gamification is modular and scalable in nature. It is frequently delivered via mobile applications, tablets, or desktop platforms and is delivered in short, incremental bursts, typically ranging from 2 to 5 minutes. Its structure allows users to engage with the content anytime and anywhere, making it ideal for modern microlearning environments (Kapp, 2014; Landers, 2014; Pho & Dinscore, 2015).

Such repetition, which is inherent in gamification, leads to constant reinforcement, which is essential for long-term learning (Harmon, 2016). Such short, structured interactions are particularly effective in classroom settings, allowing learners to cover a wide array of topics efficiently within limited time frames and with minimal effort (Pan, 2020).

Table 1. Conceptual Comparison Between Game-Based Learning & Gamification Across Key Pedagogical Dimensions

Dimension	Game-Based Learning (GBL)	Gamification
1. Nature	Full games with educational content	Game elements in non-game contexts
2. Structure	Start → Play → Stop with win state	Continuous tasks, no defined endpoint
3.User Awareness	Learners know they're playing a game	Game-like elements often unnoticed
4.LearningEnv. Immersive, settings	Immersive scenario-based, structured	Modular, flexible, used anywhere settings
5. Duration	One-time, longer immersive experiences	Short, repeatable microlearning bursts
6. Content Focus	Deep skills like decision-making	Reinforcement of basic concepts

1.5 Engagement, Motivation, And Learning Outcomes: Empirical Evidence

Empirical studies have further reinforced these assertions. Research in education has demonstrated that computer game- based learning produces comparable immediate knowledge gains compared to conventional learning methods; however, game-based learning yields superior long-term retention and higher engagement (Kanthan & Senger, 2011). The interactive, feedback-rich nature of games has been credited with promoting deeper cognitive involvement, which drives motivation.

Similarly, gamification has been shown to improve motivation and engagement across diverse domains by leveraging incremental rewards and social competition (Hamari et al., 2014). Its modular nature facilitates easy implementation, making gamification more accessible to modern learner preferences. However, studies also caution that the effectiveness of game-based approaches can vary by demographic factors such as gender and language background (Chang, Lee, Byeon, & Lee, 2015), underscoring the need for rigorous scholarly research into game-based approaches across diverse populations.

Empirical research consistently demonstrates that well-designed GBL environments can enhance student engagement, motivation, and knowledge retention compared to traditional instructional methods (Plass, Homer, & Kinzer, 2015; Wouters et al., 2013). For example, Wouters et al. (2013) found, in a meta-analysis of 77 studies, that GBL not only improved learning outcomes but also increased retention and engagement compared to conventional approaches. Plass et al. (2015) further argued that GBL's effectiveness is rooted in its ability to provide meaningful feedback that fosters a sense of supported autonomy—one of the drivers of intrinsic motivation (Xi & Hamari, 2019).

However, the literature also notes that the impact of GBL is contingent on the alignment between game mechanics and learning objectives. Gamification is not a one-size-fits-all solution; poorly designed gamification can exacerbate existing issues rather than remedy them. Learners' prior experiences and individual differences also influence the impact of GBL. Thus, while GBL holds substantial promise, its efficacy is not universal and requires careful instructional design (Hamari et al., 2016; De Freitas & Oliver, 2006; Fredricks, Blumenfeld, and Paris 2004).

1.6 Current Level of Gamification in Education

Systematic review studies indicate that gamification in education has been exponential, with an increasing number of empirical studies each year (Dicheva & Dichev, 2015). Caponetto, Earp, and Ott (2014) similarly reported a substantial increase in research and practical implementation, especially in higher education and STEM fields. The most commonly utilized gamification mechanics are points, badges, and leaderboards, with recent trends showing a rise in the use of avatars and gamification of single-course activities, such as assignments and collaborative projects. Blended learning environments and e-learning platforms are the primary contexts for gamification, reflecting the broader digitalization of educational practice. Despite this growth, the field has moved beyond the initial "peak of inflated expectations" and is now entering a phase of critical scrutiny, with a notable increase in studies reporting mixed or inconclusive results regarding the efficacy of gamification (Dicheva & Dichev, 2015).

This study aims to systematically provide clarity on research gaps, establish distinct connections between theoretical frameworks and practical applications in education, and critically analyze student perceptions of game-based learning and conventional learning in India. By addressing the critical challenges in science education and literacy, this study aims to provide empirical evidence of the efficacy of innovative pedagogical approaches. The methodology section details the nature of this research, data collection methods, selection techniques, and analytical techniques, thereby providing empirical evidence for this critical analysis.

1.7 Gaps in Existing Research

Despite the high levels of interest in conventional learning methods and game-based learning, several gaps in the existing literature convolute the clarity of the topic. The primary gaps in the current literature are as follows:

I. Inconsistent conceptual definitions: The literature tends to mix up the terms "game-based- learning" and gamification, leading to inconsistent definitions and making it difficult to compare findings across studies (Deterding et al., 2011; Werbach & Hunter, 2015)

II. Lack of quantitative evidence: There is a paucity of hands-on quantitative research and authentic, integrative assessment strategies that triangulate cognitive, affective, and behavioural outcomes, limiting understanding of the sustained impact of pedagogical innovations (Bransford et al., 2000; Shute & Ventura, 2013)

III. Limited Empirical Research: Much of the existing research on gamification and student motivation has been conducted in Western or urban contexts, with limited empirical focus on South Asia, and especially India, where educational challenges and resource constraints are markedly different (ASER Centre, 2024).

2. *Methodology*

This study utilized a rigorously designed quantitative methodology to critically analyze the comparative effects of game- based learning (GBL) and conventional learning approaches on student engagement and motivation in under-resourced government schools in India. The methodological framework is grounded in established educational psychology and learning sciences. Throughout this research, this framework utilized validated psychometric instruments, robust sampling procedures, and culturally sensitive adaptation protocols to meet the high standards of validity essential for generalizing findings. Cognizant of the gaps in existing studies, which are the persistent methodological limitations in the existing literature, overreliance on Western-centric models, and the paucity of contextually relevant data, this study was conducted with empirical precision and multidimensional emphasis. The study's design was informed by the goal of generating reliable evidence that can inform both pedagogical practice and policy shifts in resource-constrained educational environments, which can be generalized.

The methodological framework was developed with a high emphasis on the internal validity, reliability, and transferability of the findings to other resource-deprived environments. Hence, standardized data collection protocols, rigorous ethical safeguards, and strong privacy protection protocols, were employed to capture the multidimensional nature of student engagement and motivation. This approach is explicitly designed to address the complex socioeconomic factors interlinked with schooling in India.

2.1 Research Aims and Objectives

Primary Aim: The central aim of this research is to critically evaluate the different effects of game-based learning and conventional pedagogical approaches on student motivation and engagement in resources-deprived, Indian government school. This study addresses a significant empirical gap by investigating how technology-enhanced (gamification & game-based-learning) learning environments interact with student perception; in the hopes of aiding policy-intervention.

Research Objectives:

I. The objective was to empirically assess and contrast student engagement and motivation patterns across GBL and conventional classrooms by employing multidimensional engagement scales that captured motivation, engagement, and behavioral dimensions.

II. This study aimed to analyze students' perceptions and preferences regarding pedagogical approaches and perceived learning effectiveness.

By implementing a linguistically adapted and methodologically rigorous research design. This study underscores the essentiality of critical analyses in pedagogical studies. The findings are intended to enhance the generalizability and relevance of evidence-based pedagogical approaches and policy interventions for marginalized populations.

Research Hypothesis:

H1 There is a significant difference between Male and Female students in their preference for conventional learning (dependent variable).

H2 There is a significant difference between Male and Female students in their preference for game-based- learning (dependent variable).

H3 There is a significant difference between the Male and Female groups with respect to the dependent variable Student Engagement

H4 There is a difference between the Male and Female groups with respect to the dependent variable Student Motivation

H5 There is a significant difference in preference for conventional learning between students aged 13–15 and those aged 16–18.

H6 There is a significant difference in preference for game-based learning between students aged 13–15 and those aged 16–18.

H7 There is a significant difference in student motivation between students aged 13–15 and those aged 16–18.

H8 There is a significant difference in student engagement between students aged 13–15 and those aged 16–18.

H9 There is a significant negative correlation between preference for conventional learning and game-based learning.

H10 There is a significant correlation between preference for conventional learning and student motivation.

H11 There is a significant correlation between student engagement and conventional learning.

H12 There is a significant correlation between student motivation and game-based-learning.

H13 There is a significant correlation between student engagement and game-based-learning.

H14 Game-based learning preference will significantly predict student motivation

H15 Game-based learning preference will significantly predict student engagement

2.2 Variable Classification

This study used a systematic variable classification framework. Variables were categorized according to their theoretical roles within this research design, thus enabling a precise examination of the relationships between student engagement, student motivation, game-based learning (GBL), and conventional learning.

Control Variables:

I. Gender: Operationalized as a binary variable (male/female) based on self-reports. Gender was included as a control variable because of documented differences in educational technology engagement and gaming preferences (Hamari et al. 2016).

II. Age: Operationalized as a continuous variable (years). The sample was restricted to students aged 13–18 years to ensure homogeneity and adequate representation of the sample. As mentioned in the sampling techniques, responses below 13 years of age or above 18 years of age were discarded from the selection.

Dependent Variables:

I. Student Motivation: Conceptualized as a continuous variable. Further illustrated as a multidimensional construct grounded in Self-Determination Theory, it captures both intrinsic and extrinsic motivational dimensions.

II. Student Engagement: Conceptualized as a continuous variable. Reflecting the cognitive, affective, and behavioral dimensions of engagement, as theorized in multidomain engagement theories (Fredricks, Blumenfeld, & Paris, 2004).

This classification framework ensures that all variables are operationalized in alignment with established theoretical constructs. This is employed to support the validity and reliability of the subsequent statistical analyses.

2.3 Participant and Sampling Techniques

This study employed purposive sampling to select government-run schools ($n\alpha = 93$) within the Gurgaon region that had implemented game-based learning initiatives. This approach enabled focused insights into schools with relevant experiential contexts, though it does not claim statistical generalizability across India.

Quantitative data were collected using a culturally adapted questionnaire to measure student engagement and motivation levels. These instruments underscore the rigorous methods used to ensure the validity of this research. This methodologically rigorous approach aimed to generate empirically robust and generalizable findings while maintaining sensitivity to the unique sociocultural context of Indian education, thereby contributing to the broader discourse on innovative pedagogical strategies in resource-constrained educational environments.

From an initial response pool ($N\xi = 2{,}154$), systematically applied exclusion criteria ensured sample integrity and alignment with the research parameters of this study. Exclusion protocols removed participants failing age eligibility requirements ($n1 = 145$) of our target demographic: 13-18 years, ($n2 = 38$) cases with incomplete ethnicity data. Furthermore, high-minority ethnic groups were sampled to avoid the risk of wrongful generalization of this research's findings. Participants with no prior game-based learning exposure ($n3 = 124$) were sampled based on essentiality for comparative analysis. Finally, ($n4 = 31$) respondents from private educational institutions (outside the study's government school focus) were discarded.

These exclusions yielded a final analytic sample of ($N\theta = 1{,}816$ valid cases), representing an 84.3% retention rate, which exceeded the recommended thresholds for educational intervention research (WWC, 2020).

Table 2. *Showing Selection Metrics*

Selection Metrics	
Total Cases	2154
Discarded cases in the category of "Age"	145
Discarded cases in the category of "Ethnicity"	38
Discarded cases in the category "Not played game"	124
Discarded cases in the category "Private School"	31
Valid Cases:	1816

2.4 Scales and Instruments

As illustrated previously, the constructs delved into in this research—motivation and learning—are multidimensional in nature. Hence, this study employed a comprehensive, quantitative survey design to better meet the conceptual requirements. Psychometrically validated instruments were used to systematically assess students' motivation, engagement, and instructional preferences. All instruments were selected or developed based on their demonstrated internal consistency ($\alpha net > 0.80$), construct validity, and suitability for the Indian educational context of this study's setting. The measurement framework was specifically designed to enable a robust statistical analysis of the differences between game-based learning (GBL) and conventional instructional modalities, ensuring methodological rigor and empirical precision. All scales were adapted to the cultural and linguistic requirements of the sample demographic, in this case, Indian. Structured Likert-type response formats (ranging from 5-point to 7-point scales) were employed to capture nuanced variations in responses.

Student Motivation Scale: Student motivation was measured in the questionnaire using validated scales by Dayel et al. (2018). This instrument, demonstrating high internal consistency ($\alpha net = 0.8$; net as mean of $\alpha intrinsic = 0.75$, $\alpha extrinsic = 0.78$, $\alpha learning\ beliefs = 0.78$; and $\alpha self\ efficacy = 0.89$) and robust construct validity, operationalizes motivation through 20 items rated on a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree). The scale comprehensively assesses intrinsic motivation, extrinsic regulation, and amotivation, consistent with Pintrich's Social Cognitive Model. The representative items included: "I feel motivated when lessons are organized and follow a routine." and "Learning is fun because I get better at something." This multidimensional methodological framework enables precise profiling of students' motivational orientations.

Student engagement was assessed using the Student Engagement Instrument (SEI) developed by the Check & Connect Program at the University of Minnesota. This 35-item multidimensional scale, with internal consistency coefficients exceeding desired internal consistency. ($\alpha net = 0.82$; net as a mean of $\alpha relations = 0.85$; $\alpha learning = 0.82$; $\alpha goals = 0.79$; $\alpha learning\ goals = 0.79$) measures engagement across cognitive, affective, and behavioral domains using a 5-point Likert scale (1 = Strongly Agree, 5 = Strongly Disagree). The SEI includes both positively and negatively worded items to minimize response bias. Example items include: "My teachers are there for me when I need them" (affective engagement) "When I do schoolwork, I check to see whether I understand what I'm doing" (cognitive engagement) "I feel like I have a say about what happens to me at school" (behavioral engagement). The SEI's multidomain structure ensures comprehensive and reliable assessment of student engagement.

Conventional Learning Scale: A 10-item Conventional Learning Preference Scale was developed by the research team to measure student affinity for traditional, teacher-directed pedagogical approaches. Items were rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) and captured dimensions such as comfort, focus, comprehension, and preference for direct instruction. Sample items include: "I feel comfortable with regular lessons like reading, writing, and listening to the teacher." and "I think I understand topics better when they are explained step-by-step by a teacher." The scale's internal consistency and validity were established through pilot testing and expert reviews.

Game-Based Learning Preference Assessment: A parallel 10-item instrument was developed to assess GBL preferences, maintaining structural equivalence with the conventional learning scale while focusing on the game-mediated educational experience. Items utilize identical 5-point Likert formatting and include statements such as: "I think I would be more interested in lessons if they included games" and "I believe I would try harder if I was learning through games." This instrument includes a dichotomous screening question ("Have you ever learned a subject in school through a game or educational app?") to differentiate between experiential and hypothetical responses, thereby enabling nuanced analysis of preference formation mechanisms.

The quantitative measurement strategy was explicitly designed to support advanced statistical analyses, including regression, correlation, t-tests and analysis of variance. This approach enabled the examination of relationships between methods of learning, motivation, engagement, and preference constructs. All instruments underwent rigorous adaptation procedures, including translation, back-translation, and pilot testing, to ensure linguistic and cultural appropriateness for the Indian context.

2.5 Ethical Guidelines

This research adhered to rigorous ethical standards throughout the data collection process. All participants were comprehensively informed about the study's objectives, methodology, and intended use of the collected data. A detailed confidentiality and data-handling policy was provided to ensure transparency regarding data protection measures. Students were notified of this research's prohibition on data sharing with third parties for commercial, non- commercial and non-academic purposes.

Prior to participation, students were required to review comprehensive terms of participation that outlined their rights, responsibilities, and the permanent nature of the data submission. Informed consent was obtained through an embedded clause in the data collection instrument requiring explicit acknowledgment: "By continuing with this survey, you affirm that you have read and understood the terms set forth in this document, and you consent to participate under these conditions. If you do not accept these terms in full, you are advised to discontinue your participation immediately and exit the form."

All identifying information, including names, email addresses, were excluded from the analysis and publication to ensure participant anonymity. Data was immediately aggregated and anonymized upon analysis to prevent individual identification. The research protocol emphasized voluntary participation while requiring complete responses to maintain data integrity. Participants were informed that digital transmission inherently carries minimal security risks, which they accepted as part of their consent to participate.

3. Results and Findings

Table 3: Showing T-Test Results for Conventional Learning & Gender

	Gender	n	Mean	S. D	t	df	p	Cohen's d
Conventional Learning	Male	975	14.86	2.84	-1.67	1814	0.096	0.08
	Female	841	15.09	2.99				

As seen in Table 3. The analysis reveals that the mean preference for conventional learning is marginally higher among female students (M = 15.09, SD = 2.99) compared to male students (M = 14.86, SD = 2.84). However, an independent sample t-test indicates that this difference is not statistically significant as t(1814) = -1.67, and p = 0.096 ($p > 0.05$), exceeding the conventional alpha threshold of $\alpha = 0.05$. Furthermore, the effect size, as measured by Cohen's d = 0.08, suggests a negligible difference between the groups. Taken together, these results indicate that there is no meaningful gender-based variation in students' preference for conventional learning approaches. Within the context of Indian schools, this finding implies that both male and female students demonstrate similarly aligned attitudes toward traditional, teacher-directed modes of instruction. Thus H_1 which states that there would be significant differences between Male and Female students on the dependent variable of conventional learning is **rejected**.

Table 4: *Showing T-Test Results for Game-Based-Learning & Gender*

	Gender	n	Mean	S.D	t	df	p	Cohen's d
Game Based Learning	Male	975	46.33	2.95	-3.48	1814	0.001	0.16
	Female	841	46.8	2.76				

As seen in Table 4. The analysis reveals female students report a higher mean preference for game-based learning (M = 46.80, SD = 2.76)) compared to male students (M = 46.33, SD = 2.95), and this difference is statistically significant as t(1814) = -3.48, and p = 0.001. Where p is highly below the conventional alpha threshold of $\alpha = 0.05$ ($p < 0.05$). Although the effect size is small with Cohen's d = 0.16, it indicates a consistent trend in the data. These results suggest that female students in this context exhibit a significantly greater preference for game-based learning than their male peers. This finding challenges traditional assumptions about gender-based attitudes toward gaming and implies that, within Indian school settings, game-based pedagogies may hold equal or even greater appeal for female students. Thus H_2 which states that there would be significant differences between Male and Female students on the dependent variable of game-based- learning is **accepted**.

Table 5. *Showing T-Test Results for Student-Engagement & Gender*

	Gender	n	Mean	S.D	t	df	p	Cohen's d
Student Engagement	Male	975	140.26	18.9	-1.85	1814	0.064	0.09
	Female	841	141.83	16.95				

As seen in Table 5. The analysis illustrated Female students exhibiting a slightly higher mean engagement score (Mf = 141.83, SD = 16.95) compared to male students (Mm = 140.26, SD = 18.9). However, the independent samples t-test indicates that this difference is not statistically significant as t(1814) = -1.85 and p = 0.064, exceeding the conventional significance threshold of α = 0.05. The corresponding effect size, Cohen's d = 0.09, underscores a negligible difference in practical terms. These results suggest that there is no meaningful gender-based variation in overall student engagement. Both male and female students report comparably high levels of engagement, indicating equitable engagement outcomes across genders, regardless of instructional differences. Thus, H3 which states that there would be significant differences between Male and Female students on the dependent variable of student engagement is **rejected**.

Table 6: *Showing T-Test Results for Student-Motivation &Gender*

		n	Mean	S.D	t	df	p	Cohen's d
Student Motivation	Male	975	190.09	15.16	-3.07	1814	0.002	0.14
	Female	841	192.26	14.91				

Finally, as seen in Table 6, the analysis showcases that in the context of student motivation, Female students report higher mean motivation scores (M = 192.26, SD = 14.91) compared to male students (M = 190.09, SD = 15.16), and this difference is statistically significant as t(1814) = -3.07, p = 0.002. The effect size, Cohen's d = 0.14, indicates a small but consistent difference. These findings suggest that female students exhibit significantly greater levels of motivation than their male counterparts, albeit with a modest effect size. While the practical implications may be slightly limited, the result points to a meaningful gender-related trend in motivational outcomes, which may warrant consideration in the development of targeted interventions aimed at enhancing student motivation. Thus, H4 which states that there would be significant differences between Male and Female students on the dependent variable of student motivation is **accepted**.

Table 7: *Showing T-Test Results for Conventional Learning & Age Groups*

		n	Mean	S.D	t	df	p	Cohen's d
Conventional Learning	16-18	1157	15.02	2.91	1.11	1814	0.266	0.05
	13-15	659	14.86	2.92				

As seen in Table 7. The analysis of conventional learning preference across age groups (13–15 vs. 16–18 years) reveals that older students (n = 1,157) report a marginally higher mean score (M = 15.02, SD = 2.91) than younger students (n = 659; M = 14.86, SD = 2.92). However, an independent-samples t-test shows that this difference is not statistically significant, t(1,814) = 1.11, p = 0.266, and Cohen's d = 0.05 indicates a negligible effect size. Both younger and older students in Indian schools exhibit comparable orientations toward conventional learning methods. Thus, H5 which states that there would be significant difference in preference for conventional learning between students aged 13-15 and those aged 16-18 is **rejected**.

Table 8: *Showing T-Test Results for Game-Based Learning & Age Groups*

		n	Mean	S.D	t	df	p	Cohen's d
Game Based Learning	16-18	1157	46.12	2.93	-8.63	1814	<.001	0.42
	13-15	659	47.3	2.61				

As seen in Table 8, Students aged 13–15 report a markedly higher mean preference for game-based learning (M = 47.30. SD = 2.61) than their older peers aged 16–18 (M = 46.12, S.D = 2.93). An independent-samples t-test confirms this difference is highly significant, t(1,814) = –8.63, p < .001, and the effect size (Cohen's d = 0.42) denotes a moderate practical impact. These results indicate that early adolescents in Indian schools exhibit a substantially stronger orientation toward game-based pedagogies than older students, suggesting that gamified instructional interventions may be particularly salient and engaging for the 13–15 age cohort. Thus H6 which states that there would be significant difference in preference for game-based-learning between students aged 13-15 and those aged 16-18 is **accepted**.

Table 9: *Showing T-Test Results for Student Motivation & Age Groups*

		n	Mean	S.D	t	df	p	Cohen's d
Student Motivation	16-18	1157	189.48	15.21	-6.11	1814	<.001	0.3
	13-15	659	193.93	14.44				

As seen in Table 9. Students aged 13–15 exhibited a higher mean motivation score (M = 193.93, SD = 14.44) than those aged 16–18 (M = 189.48, SD =15.21). An independent-samples t-test confirmed this difference as highly significant, t(1,814) = –6.11, p < .001, and the effect size (Cohen's d = 0.30) reflects a small-to-moderate practical impact. These results indicate that younger adolescents in Indian schools demonstrate substantially greater motivation than their older counterparts. This age-related decline in motivation suggests that targeted interventions—particularly those leveraging game-based learning strategies—may be especially important for sustaining and enhancing student engagement as learners advance through secondary school. Thus H7 states that there would be significant difference in student motivation between students aged 13-15 and those aged 16-18 is **accepted**.

Table 10: *Showing T-Test Results for Student Engagement & Age Groups*

		n	Mean	S.D	t	df	p	Cohen's d
Student Engagement	16-18	1157	139.18	18.73	-5.71	1814	<.001	0.28
	13-15	659	144.16	16.28				

As seen in Table 10. Students aged 13–15 demonstrated a higher mean engagement score (M = 144.16, SD =16.28) than those aged 16–18 (M = 139.18, SD = 18.73). An independent-samples t-test shows this difference to be statistically significant, t(1,814) = –5.71, p < .001, and the effect size (Cohen's d = 0.28) indicates a small practical impact. These findings reveal that younger adolescents in Indian schools are notably more engaged than their older peers. Although the effect is modest, the pattern suggests a gradual decline in engagement as students advance through secondary school, underscoring the potential value of age-tailored pedagogical strategies to sustain engagement across grade levels. Thus H8 which states that there would be significant engagement in student motivation between students aged 13-15 and those aged 16-18 is **accepted.**

Table 11: *Showing Correlation Between Conventional Learning, GBL, Student Motivation & Student Engagement*

		Conventional Learning	Game Based Learning	Student Motivation	Student Engagement
Conventional Learning	Correlation	1	-0.06	-0.02	-0.1
	p		0.006	0.36	<.001
Game Based Learning	Correlation	-0.06	1	0.67	0.71
	p	0.006		<.001	<.001
Student Motivation	Correlation	-0.02	0.67	1	0.72
	p	0.36	<.001		<.001
Student Engagement	Correlation	-0.1	0.71	0.72	1
	p	<.001	<.001	<.001	

As seen in Table 11. The Pearson correlation between conventional learning preference and game-based learning preference was weakly negative, with r = –0.06, p = .006, indicating a statistically significant relationship at the α = 0.05 level. In practical terms, this suggests that students who express a stronger inclination toward traditional, teacher- directed instruction tend to exhibit slightly lower enthusiasm for game-based learning, and students who express a stronger preference towards game-based-learning tend to show lower enthusiasm for game-based learning. However, the magnitude of this effect is minimal, implying that the two preferences are largely independent and that favoring one approach does not strongly predict disfavoring the other. H9 is **accepted.**

The Pearson correlation between conventional learning preference and student motivation was very weak and non- significant with r = –0.02, p = .36. The p-value exceeds the conventional α = 0.05 threshold, the findings fail to reject the null hypothesis of no linear association. In practical terms, this indicates that students' motivational levels bear no meaningful relationship to their orientation toward traditional, teacher-directed instruction in this Indian school sample. H10 is **rejected.**

Next, the correlation between preference for conventional learning and student engagement was weakly negative with r= –0.10, p < .001, indicating a statistically significant relationship at the α = 0.05 level. In practical terms, students who favor traditional, teacher-directed instruction tend to report slightly lower engagement; however, the effect size is minimal, suggesting that preference for conventional learning accounts for only a small fraction of the variance in engagement. Consequently, while this negative association is reliable, other factors are likely far more influential in shaping student engagement. H11 is **accepted.**

For game-based learning and student motivation, the correlation was strong and statistically significant with r = 0.67, p< .001. This indicates a strong positive relationship: students who express greater preference for game-based instructional approaches also tend to report substantially higher levels of motivation. The strength of this association underscores the potential of game-based pedagogies to enhance student motivation, particularly within the context of Indian government schools, and suggests that integrating such approaches may play a critical role in fostering sustained learner engagement in underserved communities. H12 is **accepted.**

Lastly, correlation between preference for game-based learning and student engagement was strong and statistically significant with $r = 0.71$, $p < .001$. This indicates a strong positive association: students who favor game-based instructional modalities tend to exhibit markedly higher levels of engagement. The strength of this correlation highlights the considerable potential of game-based strategies to enhance student engagement, reinforcing their relevance as effective pedagogical tools in educational contexts. H13 is **accepted.**

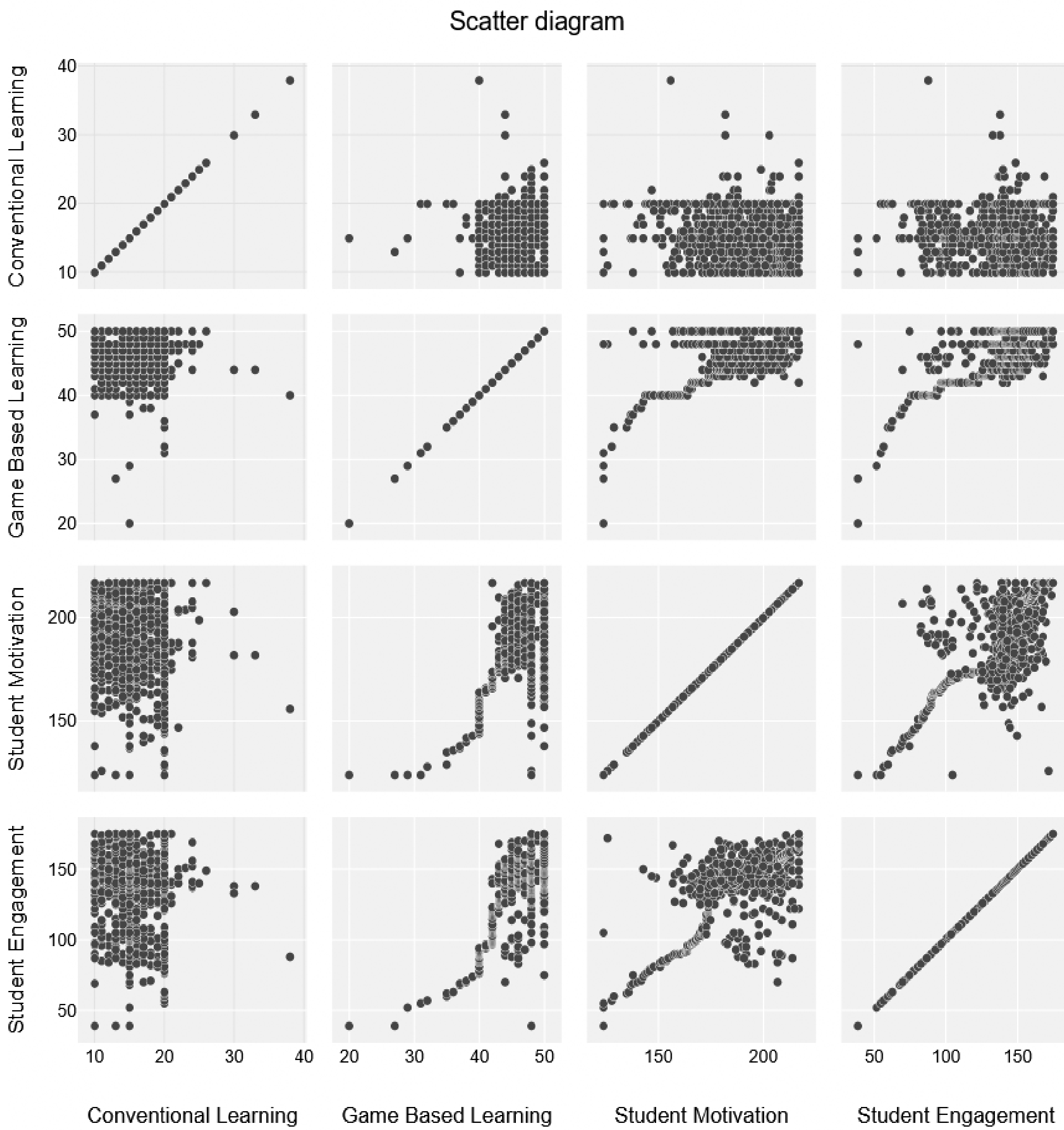

Figure 1. *Showing The Correlation Relation Between Conventional Learning, Game Based Learning, Student Motivation, And Student Engagement*

In evaluating the relation between student's preferences, several key patterns emerged. First, there is a weak but statistically significant negative correlation between preference for conventional learning and preference for game-based learning. This finding indicates that, although students who favor teacher-directed instruction tend to be marginally less enthusiastic about game-based modalities. When conventional learning preference was correlated with student motivation, the association was effectively zero signifying no meaningful linear relationship. In other words, a student's orientation toward traditional pedagogies provides no reliable indication of their motivation level. A similarly small inverse relationship emerged between conventional learning preference and student engagement; this weak effect implies that conventional learning accounts for only a tiny fraction of the variance in engagement, and other factors are likely far more determinative. By contrast, preferences for game-based learning demonstrated robust positive associations with both motivation and engagement. Students who expressed a stronger affinity for game-based instructional approaches reported substantially higher motivation and markedly greater engagement . Collectively, these results underscore that conventional pedagogical approaches result in little practical influence on student motivation, with a marginal negative link to engagement. In contrast, game-based learning preferences are strongly and positively linked with both engagement and motivation. This evidence points to the considerable promise of game-based pedagogies as effective tools for enhancing student motivation and engagement in under-resourced environments where traditional approaches have shown limited impact.

Table 12: *Showing Regression of Motivation, And Conventional & Game Based Learning*

Model	B	Beta	S.E	t	p	R^2
Constant	25.22		4.56	5.53	<.001	
Conventional Learning	0.11	0.02	0.09	1.25	0.212	0.45
Game Based Learning	3.53	0.67	0.09	38.54	<.001	

**Dependent variable = student motivation*

The multiple regression model predicts student motivation from both game-based learning (GBL) preference and conventional learning preference with an R^2 of 0.45. This indicates that 45% of the variance in motivation scores is accounted for by the combined influence of these two predictors, a notably strong fit for educational research in real- world settings.

As shown in Table 12, Game-based learning preference emerges as the principal driver of student motivation. Holding conventional learning preference constant, each one-unit increase in GBL scores corresponds to a 3.53-unit rise in motivation (unstandardized B = 3.53). The standardized beta coefficient of 0.67 further attests to the large, positive strength of this relationship. The effect is highly robust, as evidenced by a t-value of 38.54 and $p < .001$. In practical terms, these results confirm that the more students favor gamified instructional modalities, the more motivated they become—underscoring the potent motivational leverage offered by game-based pedagogies in Indian schools.

By contrast, conventional learning preference contributes negatively to the prediction of motivation once GBL preference is taken into account. The unstandardized coefficient of 0.11 indicates that a one-unit increase in conventional preference produces only a 0.11-unit increase in motivation, and the standardized beta of 0.02 reflects its minimal effect size. Statistically, this predictor fails to reach significance ($t = 1.25$, $p = .212$), implying that, in the context of this model, traditional instructional orientation does not exert a meaningful independent influence on motivational outcomes.

Collectively, these findings highlight game-based learning preference as the dominant motivational predictor, with its large standardized beta and highly significant effect driving the model's explanatory power. Conventional learning preference, by contrast, offers no unique predictive value beyond that captured by GBL orientation. The model's R^2 of 0.45 underscores that attitudes toward game-based instruction alone account for nearly half of the variation in motivation among Indian secondary-school students. These empirical results provide compelling support for integrating game-based pedagogical strategies to bolster student motivation, while suggesting that reliance on conventional teaching methods will yield limited motivational benefit in this context. Thus H15 which states that game-based-learning will significantly predict student motivation is **accepted**.

Table 13: *Showing Regression of Engagement and Conventional & Game Based Learning*

Model	B	Beta	S.E	t	p	R^2
Constant	-59.85		5.19	-11.54	<.001	
Conventional Total	-0.32	-0.05	0.1	-3.07	0.002	0.5
GBL total	4.42	0.7	0.1	42.4	<.001	

**Dependent variable = student engagement*

The multiple regression model predicts student engagement from both game based learning (GBL) preference and conventional learning preference with an R^2 of 0.5. This indicates that 50 percent of the variance in engagement scores is accounted for by the combined influence of these two predictors, a significantly high fit for educational research in real world settings, further higher than motivation.

When both predictors are entered together, game-based learning preference emerges as the principal driver of engagement. Specifically, each one-unit increase in GBL preference corresponds to a 4.42-point rise in engagement (B = 4.42), and its standardized beta of 0.70 confirms it as a very strong predictor. This relationship is highly robust ($t = 42.40$, $p < .001$), demonstrating that students who favor gamified instructional approaches consistently report substantially higher engagement.

In contrast, conventional learning preference exhibits a modest negative association with engagement once GBL preference is controlled. A one-unit increase in conventional preference predicts a 0.32-point decrease in engagement (B = –0.32), with a small standardized beta of –0.05. Although this effect is comparatively minor, it is statistically reliable ($t = –3.07$, $p = .002$), indicating that, independent of game-based orientation, stronger affinity for traditional, teacher-directed methods is linked to slightly lower engagement.

Together, these predictors explain half of the variance in student engagement ($R^2 = 0.50$), reflecting a notably high degree of explanatory power for educational field research. The lion's share of this model fit derives from game-based learning preference, underscoring its dominant role in shaping engagement outcomes. Meanwhile, the small but significant negative contribution of conventional learning preference suggests that traditional pedagogies may slightly undermine engagement when students are simultaneously considering game-based alternatives. Thus H16 which states that game-based-learning will significantly predict student engagement is **accepted**.

These results provide rigorous empirical support for the integration of game-based pedagogical strategies in Indian secondary-school contexts: GBL preference not only predicts but substantially drives student engagement. By contrast, conventional instructional orientation appears to detract modestly from engagement when weighed against gamified approaches. Educators and curriculum designers aiming to maximize learner involvement should therefore prioritize game-based elements, while recognizing that an overemphasis on traditional methods may inadvertently dampen student engagement.

4. Discussion

This study critically examined the differential impacts of game-based, and conventional pedagogical approaches on multidimensional learning outcomes in Indian science classrooms.

The findings of this research substantially align with and extend with existing empirical evidence regarding the efficacy of gamified and game-based pedagogical approaches in enhancing student motivation and engagement. The observed strong positive correlations between game-based learning preference and both student motivation and engagement corroborate recent systematic reviews and critical analyses that consistently demonstrate gamification's capacity to enhance motivational outcomes across diverse educational contexts. These effect sizes align closely with Kim and Castelli's (2021) meta-analytic findings, which reported moderate to large positive effects (Cohen's d = 0.48) for gamified interventions on behavioral change in educational settings. However, this research's findings notably contrast with studies that have reported mixed or inconclusive outcomes. Particularly, those examining longer-term implementations. The gender-based findings, where female students demonstrated significantly higher preferences for game-based learning approaches, challenge traditional assumptions about gaming preferences. Furthermore, this challenge aligns with emerging research suggesting that digital learning games may be more effective for female students than commonly presumed (Alotaibi, 2024; Alsofyani, 2022; Dan et al., 2024; McLaren et al., 2022; Nadeem et al., 2023; Pittser, 2024). The age-related decline in preference for game-based learning among older adolescents (16-18 years) supports recent concerns about the persistent efficacy of gamification effects over extended periods; Furthermore, this aligns with research indicating that brief interventions are significantly more effective than longer-term implementations (Abedi et al., 2019; Bailey et al., 2020; Schmidt et al., 2023).

weak correlations between conventional learning preferences and motivational outcomes provide empirical support for pedagogical approaches in resource-constrained environments, particularly in developing countries where technology integration faces significant logistic challenges (Ratinho & Martins, 2023; Kim & Castelli, 2021; Baker et al., 2025; Educational Technology Debate, 2024; Ghoulam et al., 2024).. The study's findings that game-based learning preferences account for 45% of variance in motivation and 50% of variance in engagement represent substantial effect sizes that exceed many reported outcomes in prevalent educational technology research. This aligns with recent meta-analyses and empirical studies demonstrating that game-based learning significantly enhances student motivation and engagement (Zhang & Yu, 2022; Chen et al., 2021). For example, Zhang and Yu (2022) reported strong positive effects of GBL on both motivation and achievement, while Chen et al. (2021) found that digital games notably increased students' interest and learning efficiency. Additional research confirms that GBL fosters higher participation, enjoyment, and attentiveness (Lan Dinh Thi, 2025; Agustina & Jolanons, 2024), and also supports cognitive and social development (Nisbet, 2024;). Collectively, these findings highlight the multifaceted benefits of game-based learning, and its potential to surpass traditional educational technology approaches in promoting student motivation and engagement. (Apriani, Apriani, & Prastiawan, 2019; Al-Khayat, Gargash, & Atiq, 2023). This underscores that the cultural adaptation of gamified approaches to Indian educational contexts may have enhanced their effectiveness beyond what has been observed in predominantly Western-centric studies. (ALNAP, 2001; Collaborators, 2024; Racherla, 2025; Cruchinho et al., 2024).

5. Conclusion

This study provides a comparative analysis of conventional and game-based pedagogical approaches in under-resourced Indian secondary schools, revealing that game-based learning (GBL) exerts a substantially greater positive influence on student motivation and engagement than traditional teacher-directed approaches. By employing validated, multidimensional instruments and sampling across diverse government schools, the research demonstrates that preferences for GBL are strongly and positively associated with both motivational and engagement outcomes, whereas conventional learning preferences show negligible or even slightly negative relationships with these constructs. Notably, younger adolescents and female students exhibit higher affinity and benefit from GBL, challenging prevailing assumptions about demographic differences in educational technology. These results highlight the transformative potential of integrating game-based strategies into curricula to address persistent educational challenges in resource- constrained environments.

6. Limitations

Few methodological limitations constrain the generalizability and interpretation of these findings. The reliance on self- reported data through Likert-scale instruments introduces potential response bias, social desirability effects, and cultural adaptation. Such potential biases may have influenced participant responses, in self-reported data. Next, the methodological design prevents causal inferences about the relationships between pedagogical preferences and learning outcomes. Furthermore, the study's focus on schools in India limits generalizability to other educational contexts or cultural settings. Additionally, the exclusion of participants without prior game-based learning exposure may have introduced selection bias, while the linguistic adaptation of Western-developed instruments, despite rigorous translation procedures, may not have fully captured linguistically specific constructs.

7. Future recommendations and policy interventions

Future research should employ longitudinal designs, incorporate objective behavioral measures alongside self-reported data, and examine the long-term sustainability of gamification effects across diverse cultural and socioeconomic contexts—such as tracking students' engagement and performance in a gamified classroom over a year using platform data and motivation surveys, and implementing gamification in schools from different cultures, collecting digital activity logs and self-reports over a semester to assess the long-term, cross-cultural sustainability of effects.

Based on the findings, three actionable policy frameworks are proposed to translate empirical insights into systemic change. First, national teacher training reforms should restructure certification programs to include pedagogical hybridization modules. This training must equip educators to design gamified reward systems aligned with regional learning objectives, develop hyperlocal game-based scenarios using community-specific contexts—such as agriculture- based science challenges in farming communities—and implement triangulated assessment strategies that synthesize cognitive tests, affective self-reports, and behavioral analytics. Such reforms would bridge theoretical rigor with contextual implementation.

Second, infrastructure-agnostic digital frameworks should guide state-level edtech policies, prioritizing offline- compatible gamification tools like SMS-based quizzes and physical progress boards for electricity-scarce regions.

Concurrently, open-source repositories for culturally adapted game-based learning templates and mobile assessment kits for behavioral data collection in remote schools would democratize access while respecting socioeconomic constraints. These measures would transform technological limitations into opportunities for innovation.

Third, longitudinal equity audits must be institutionalized as mandatory five-year evaluations. These should systematically track retention disparities across gender and caste cohorts in gamified environments, analyze cost-per- outcome efficiency of hybrid models versus conventional approaches, and assess transferability of skills to livelihood activities such as agro-science applications. Such audits would ensure accountability while generating evidence for iterative policy refinement.

8. Conflict of Interest:

The author declares no conflicts of interest and acknowledges that the research was conducted without external funding that could have influenced the study design or interpretation of results.

9. References

5 Key Barriers to Educational Technology Adoption in the Developing World « Educational Technology Debate. (2024). Retrieved June 24, 2025, from https://edutechdebate.org/2014- ict4edu-trends/5-key-barriers-to-educational-technology-adoption-in-the-developing-world/

Abedi, B., Reardon, S., Winters, K. C., & Lee, S. (2019). Long-Term Outcome of a Brief Intervention to Address Adolescent Drug Abuse in a School Setting. Journal of Child & Adolescent Substance Abuse, 28(2), 132–141. https://doi.org/10.1080/1067828X.2019.1623146

Agustina, I., Joshua, W., Julanos, J., & Niva, M. (2024). The Impact of Implementing Game- Based Learning on Student Motivation and Engagement. Journal Emerging Technologies in Education, 2(3), Article 3. https://doi.org/10.70177/jete.v2i3.1069

Al-Khayat, M. R., Gargash, M. U., & Atiq, A. F. (2023). The Effectiveness of Game-based Learning in Enhancing Students' Motivation and Cognitive Skills. Journal of Education and Teaching Methods, 2(3), 50-62, Article 3. Retrieved from https://gprjournals.org/journals/index.php/jetm/article/view/199

Alsofyani, M. M. (2022). Eleven game elements for female nonadaptive gamification courses. Heliyon, 9(1), e12699. https://doi.org/10.1016/j.heliyon.2022.e12699

Anderson, J. R., Betts, S., Ferris, J. L., & Fincham, J. M. (2011). Cognitive and metacognitive activity in mathematical problem solving: Prefrontal and parietal patterns. Cognitive, Affective, & Behavioral Neuroscience, 11(1), 52–67. https://doi.org/10.3758/s13415-010-0011-0

Apriani, R. R., Apriani, R., & Prastiawan, A. (2019). Impact of game-based learning on learning motivation high school students (pp. 602–606). https://doi.org/10.2991/icet-19.2019.148

ASER 2022 - ASER: Annual Status of Education Report. (2022). https://Asercentre.Org/.Retrieved June 21, 2025, from https://asercentre.org/aser-2022/

ASER 2024 - ASER: Annual Status of Education Report. (2024). https://Asercentre.Org/.Retrieved June 20, 2025, from https://asercentre.org/aser-2024/

Bailey, D. H., Duncan, G. J., Cunha, F., Foorman, B. R., & Yeager, D. S. (2020). Persistence and

Fade-Out of Educational-Intervention Effects: Mechanisms and Potential Solutions. Psychological Science in the Public Interest, 21(2), 55–97. https://doi.org/10.1177/1529100620915848

Baker, R. S., Richey, J. E., Zhang, J., Karumbaiah, S., Andres-Bray, J. M., Nguyen, H. A., Andres, J. M. A. L., & McLaren, B. M. (2025). Gaming the system mediates the relationship between gender and learning outcomes in a digital learning game. Instructional Science, 53(2), 203–238. https://doi.org/10.1007/s11251-024-09679-3

Bin Dayel, S., Alqahtani, N., Alshehri, F. S., Alshahrani, M. M., & Alshahrani, A. A. (2018). Psychometrics of a motivation questionnaire. International Journal of Medical Education, 9, 309–315. https://doi.org/10.5116/ijme.5bec.81cf

Bloom, B. S. (1956). Taxonomy of Educational Objectives, Handbook I: Cognitive Domain. New York: David McKay Company. Inc., 1956. 207 Pp. Retrieved from: https://eclass.uoa.gr/modules/document/file.php/PPP242/Benjamin%20S.%20Bloom%20%20Taxonomy%20of%20Educational%20Objectives%2C%20Handbook%201_%20Cognitive%20Domain-Addison%20Wesley%20Publishing%20Company%20%281956%29.pdf

Bransford, J. & National Research Council (Eds.). (2004). How people learn: Brain, mind, experience, and school (Expanded ed., 9. print). National Academy Press.

Bransford, J., National Research Council (U.S.), & National Research Council (U.S.) (Eds.). (2000). How people learn: Brain, mind, experience, and school (Expanded ed). National Academy Press.

Bransford, John D., Ann L. Brown, and Rodney R. Cocking. How people learn. Vol. 11. Washington, DC: National academy press, 2000. Retrieved from: https://www.csun.edu/~SB4310/How%20People%20Learn.pdf

Caponetto, I., Earp, J., & Ott, M. (2014, October). Gamification and education: A literature review. In European conference on games based learning (Vol. 1, p. 50).

Chang, E., Lee, A., Byeon, E., & Lee, S. M. (2015). Role of motivation in the relation between perfectionism and academic burnout in Korean students. Personality and Individual Differences, 82, 221–226. https://doi.org/10.1016/j.paid.2015.03.027

Chang, K.-C., Hsu, Y.-T., Cheng, Y.-S., & Kuo, N.-T. (2019). How work engagement influences relationship quality: the roles of work motivation and perceived service guarantee strength. Total Quality Management & Business Excellence, 1–25. https://doi:10.1080/14783363.2019.1700107

Ciani, K. D., Sheldon, K. M., Hilpert, J. C., & Easter, M. A. (2011). Antecedents and trajectories of achievement goals: A self-determination theory perspective. British Journal of Educational Psychology, 81(2), 223–243. https://doi.org/10.1348/000709910X517399

Collaborators, Q. (2024, August 27). Cross-Cultural Research: Methods, Challenges, & Key Findings. QuestionPro. https://www.questionpro.com/blog/cross-cultural-research/ Conducting Research Across Cultures: Overcoming Drawbacks and Obstacles. (2001, January 1).ALNAP. https://alnap.org/help-library/resources/conducting-research-across-cultures- overcoming-drawbacks-and-obstacles/

Connolly, T. M., Boyle, E. A., MacArthur, E., Hainey, T., & Boyle, J. M. (2012). A systematic literature review of empirical evidence on computer games and serious games. Computers & Education, 59(2), 661–686. https://doi.org/10.1016/j.compedu.2012.03.004

Cruchinho, P., López-Franco, M. D., Capelas, M. L., Almeida, S., Bennett, P. M., Silva, M. M. da, Teixeira, G., Nunes, E., Lucas, P., & Gaspar, F. (2024). Translation, Cross-Cultural Adaptation, and Validation of Measurement Instruments: A Practical Guideline for Novice Researchers. Journal of Multidisciplinary Healthcare, 17, 2701–2728. https://doi.org/10.2147/JMDH.S419714

Dan, N. N., Trung, L. T. B. T., Nga, N. T., & Dung, T. M. (2024). Digital game-based learning in mathematics education at primary school level: A systematic literature review. Eurasia Journal of Mathematics, Science and Technology Education, 20(4), em2423. https://doi.org/10.29333/ejmste/14377

Darling-Hammond, L., & Snyder, J. (2000). Authentic assessment of teaching in context. Teaching and Teacher Education, 16(5), 523–545. https://doi.org/10.1016/S0742- 051X(00)00015-9

De Freitas, S., & Oliver, M. (2006). How can exploratory learning with games and simulations within the curriculum be most effectively evaluated? Computers & Education, 46(3), 249–264. https://doi.org/10.1016/j.compedu.2005.11.007

De Houwer, J., Barnes-Holmes, D., & Moors, A. (2013). What is learning? On the nature and merits of a functional definition of learning. Psychonomic Bulletin & Review, 20(4), 631–642. https://doi.org/10.3758/s13423-013-0386-3

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining Gamification. In Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments, MindTrek 2011 (Vol. 11, p. 15). https://doi.org/10.1145/2181037.2181040

Dicheva, D., & Dichev, C. (2015, October). Gamification in education: Where are we in 2015?. In E-learn: World conference on E-learning in corporate, government, healthcare, and higher education (pp. 1445-1454). Association for the Advancement of Computing in Education (AACE). Retrieved from: https://www.learntechlib.org/p/152186/?nl=1

Domjan, M. (2013). Conditioning and Learning. In Encyclopedia of Sciences and Religions (pp. 464–471). Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-8265-8_633

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. Review of educational research, 74(1), 59-109.

Frey, B. S. (1992). Tertium Datur: Pricing, Regulating and Intrinsic Motivation. Kyklos, 45(2), 161–184. https://doi.org/10.1111/j.1467-6435.1992.tb02112.x

Gee, J. P. (2003). What video games have to teach us about learning and literacy. Computers in entertainment (CIE), 1(1), 20-20.

Ghoulam, K., Bouikhalene, B., Babori, A., & Falih, N. (2024). Gamification in E-learning: Bridging Educational Gaps in Developing Countries. International Journal of Advanced Corporate Learning (iJAC), 17(1), pp. 85–95. https://doi.org/10.3991/ijac.v17i1.47631

Gulikers, J. T. M., Bastiaens, T. J., & Kirschner, P. A. (2004). A five-dimensional framework for authentic assessment. Educational Technology Research and Development, 52(3), 67–86. https://doi.org/10.1007/BF02504676

Hall, B. K. (2003). Unlocking the Black Box between Genotype and Phenotype: Cell Condensations as Morphogenetic (modular) Units. Biology and Philosophy, 18(2), 219–247. https://doi.org/10.1023/A:1023984018531

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does Gamification Work? -- A Literature Review of Empirical Studies on Gamification. 2014 47th Hawaii International Conference on System Sciences, 3025–3034. https://doi.org/10.1109/HICSS.2014.377

Hamari, J., Shernoff, D. J., Rowe, E., Coller, B., Asbell-Clarke, J., & Edwards, T. (2016). Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning. Computers in Human Behavior, 54, 170–179. https://doi.org/10.1016/j.chb.2015.07.045

Harmon, J. L. (2016). Differences in motivation and game scores between middle school students completing digital game-based learning tasks with and without supports of autonomy and structure. Liberty University.

Kanthan, R., & Senger, J. L. (2011). The impact of specially designed digital games-based learning in undergraduate pathology and medical education. Archives of pathology & laboratory medicine, 135(1), 135-142.

Kapp, K. M. (2013). The Gamification of Learning and Instruction Fieldbook: Ideas into Practice. John Wiley & Sons.

Kim J, Castelli DM. Effects of Gamification on Behavioral Change in Education: A Meta- Analysis. Int J Environ Res Public Health. 2021 Mar 29;18(7):3550. doi: https://doi.org/10.3390/ijerph18073550

Kim, S. (2013). Neuroscientific Model of Motivational Process. Frontiers in Psychology, 4. https://doi:10.3389/fpsyg.2013.00098

Krathwohl, D. R., Bloom, B., & Masia, B. B. (1964). Taxonomy of educational objectives (Vol. 2). David McKay Company.

Lachman, S. J. (1997). Learning is a Process: Toward an Improved Definition of Learning. The Journal of Psychology, 131(5), 477–480. https://doi:10.1080/00223989709603535

Lakerveld, J., Palmeira, A. L., Van Duinkerken, E., Whitelock, V., Peyrot, M., & Nouwen, A.(2020). Motivation: Key to a healthy lifestyle in people with diabetes? Current and emerging knowledge and applications. Diabetic Medicine, 37(3), 464–472. https://doi.org/10.1111/dme.14228

Lan Dinh Thi (2025). Game-based learning in improving student engagement. International Journal of Research and Innovation in Social Science, 9(5). Retrieved June 27, 2025, from https://rsisinternational.org/journals/ijriss/articles/game-based-learning-in-improving-student-engagement/ doi: https://doi.org/10.47772/IJRISS.2025.905000397

Landers, R. N. (2014). Developing a theory of gamified learning: Linking serious games and gamification of learning. Simulation & gaming, 45(6), 752-768.

Mayer, R. E. (2002). Multimedia learning. In Psychology of learning and motivation (Vol. 41, pp. 85-139). Academic Press.

Mayer, R. E. (2002). Rote Versus Meaningful Learning. Theory Into Practice, 41(4), 226–232. https://doi.org/10.1207/s15430421tip4104_4

McLaren, B. M., Richey, J. E., Nguyen, H. A., & Mogessie, M. (2022, January). A digital learning game for mathematics that leads to better learning outcomes for female students: Further evidence. In

ECGBL 2022 16th European Conference on Game-Based Learning. Academic Conferences and publishing limited.

Michou, A., Matos, L., Gargurevich, R., Gumus, B., & Herrera, D. (2016). Building on the Enriched Hierarchical Model of Achievement Motivation: Autonomous and Controlling Reasons Underlying Mastery Goals. Psychologica Belgica, 56(3), 269–287. https://doi.org/10.5334/pb.281

Morris, L. S., Grehl, M. M., Rutter, S. B., Mehta, M., & Westwater, M. L. (2022). On what motivates us: A detailed review of intrinsic v. extrinsic motivation. Psychological Medicine, 52(10), 1801–1816. https://doi.org/10.1017/S0033291722001611

Nadeem, M., Oroszlanyova, M., & Farag, W. (2023). Effect of Digital Game-Based Learning on Student Engagement and Motivation. Computers, 12(9), Article 9. https://doi.org/10.3390/computers12090177

Nisbet, Jordan(2024) Game-Based Learning: Pros, Cons & Implementation Tips for Educators.
Retrieved from, https://www.prodigygame.com/main-en/blog/game-based-learning

Ormrod, J. E., & Jones, B. D. (2023). Essentials of educational psychology: Big ideas to guide effective teaching (Sixth edition). Pearson.

Ormrod, J. E., & Mcdevitt, T. M. (2008). Fostering conceptual change about child development in prospective teachers and other college students. Child Development Perspectives, 2(2), 85-91.

Ozdemir Oz, A., Lane, J. F., & Michou, A. (2016). Autonomous and controlling reasons underlying achievement goals during task engagement: Their relation to intrinsic motivation and cheating. Educational Psychology, 36(7), 1160–1172. https://doi.org/10.1080/01443410.2015.1109064

Pan, X. (2020). Technology Acceptance, Technological Self-Efficacy, and Attitude Toward Technology-Based Self-Directed Learning: Learning Motivation as a Mediator. Frontiers in Psychology, 11. https://doi:10.3389/fpsyg.2020.564294

Pan, X. (2023). Online learning environments, learners' empowerment, and learning behavioral engagement: The mediating role of learning motivation. Sage Open, 13(4), https://doi.org/10.1177/21582440231205098

Park, S. W. (2017). Motivation theories and instructional design. Foundations of learning and instructional design technology.

Pekrun, R. (2011). Emotions as Drivers of Learning and Cognitive Development. New
Perspectives on Affect and Learning Technologies, 23–39. https://doi:10.1007/978-1-4419-9625- 1_3

Peters, R. S. (2015). The Concept of Motivation. Routledge. https://doi.org/10.4324/9781315712833

Pho, A., & Dinscore, A. (2015). Game-based learning. Tips and trends, 2.

Piaget, J. (1964). Cognitive Development in Children: Development and Learning. Journal of Research in Science Teaching, 2, 176-186. http://dx.doi.org/10.1002/tea.3660020306

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. Journal of educational psychology, 82(1), 33.

Pintrich, P. R., & Groot, E. V. D. (n.d.). Motivational and Self-Regulated Learning Components of Classroom Academic Performance.

Pittser, B. (2024, September 25). Research Roundup: 2024 Studies on Game-based Learning.

Filament Games. https://www.filamentgames.com/blog/research-roundup-2024-studies-on-game- based-learning/

Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of Game-Based Learning. Educational Psychologist, 50(4), 258–283. https://doi.org/10.1080/00461520.2015.1122533

Rabey, G. P. (2001). Motivation is response. Industrial and commercial training, 33(1), 26-28. Racherla, J. (2025, February 28). Are we really measuring what matters? The hidden challenges of studying children across cultures « News# « Cambridge Core Blog. https://www.cambridge.org/core/blog/2025/02/28/are-we-really-measuring-what-matters-the- hidden-challenges-of-studying-children-across-cultures/

Ratinho E, Martins C. The role of gamified learning strategies in student's motivation in high school and higher education: A systematic review. Heliyon. 2023 Aug 9;9(8):e19033. doi: https://doi.org10.1016/j.heliyon.2023.e19033

Reiss, S. (2012). Intrinsic and Extrinsic Motivation. Teaching of Psychology, 39(2), 152–156. https://doi.org/10.1177/0098628312437704

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. Contemporary Educational Psychology, 25(1), 54–67. https://doi:10.1006/ceps.1999.1020

Schmidt, N. B., Capron, D., Raines, A. M., Albanese, B., Short, N., Mathes, B. M., Morabito, D. M., Saulnier, K., & Allan, N. (2023). Evaluating the long-term (Three Year) durability of brief interventions targeting risk factors for psychopathology. Journal of Anxiety Disorders, 96, 102710. https://doi.org/10.1016/j.janxdis.2023.102710

Schunk, D. H., & Usher, E. L. (2012). Social cognitive theory and motivation. The Oxford handbook of human motivation, 2, 11-26.

Schunk, D. H., Meece, J. L., & Pintrich, P. R. (2014). Motivation in education: Theory, research, and applications (4th ed.). Upper Saddle River, NJ: Pearson.

Sekhar, C., Patwardhan, M., & Singh, R. Kr. (2013). A literature review on motivation. Global Business Perspectives, 1(4), 471–487. https://doi.org/10.1007/s40196-013-0028-1

Shaffer, D. W., Squire, K. R., Halverson, R., & Gee, J. P. (2005). Video Games and the Future of Learning. Phi Delta Kappan, 87(2), 105–111. https://doi.org/10.1177/003172170508700205

Shute, V., & Ventura, M. (2013). Stealth Assessment: Measuring and Supporting Learning in Video Games. The MIT Press. https://doi.org/10.7551/mitpress/9589.001.0001

Shute, V., & Wang, L. (2016). Assessing and Supporting Hard-to-Measure Constructs in Video

Games. In A. A. Rupp & J. P. Leighton (Eds.), The Handbook of Cognition and Assessment (pp. 535–562). John Wiley & Sons, Inc. https://doi.org/10.1002/9781118956588.ch22

Shute, V., & Wang, L. (2016). Assessing and supporting hard-to-measure constructs in video games. The Wiley handbook of cognition and assessment: Frameworks, methodologies, and applications, 535-562.

Simon, B., Loewy, M., Stürmer, S., Weber, U., Freytag, P., Habig, C., Kampmeier, C., & Spahlinger, P. (1998). Collective identification and social movement participation. Journal of Personality and Social Psychology, 74(3), 646–658. https://doi.org/10.1037/0022-3514.74.3.646

Skinner, B. F. (1965). Science and human behavior (No. 92904). Simon and Schuster.

Standage, M., Duda, J., & Ntoumanis, N. (2003). Predicting motivational regulations in physical education: The interplay between dispositional goal orientations, motivational climate andperceived competence. Journal of Sports Sciences, 21(8), 631–647.https://doi.org/10.1080/0264041031000101962

Student Engagement Instrument. (n.d.). Retrieved June 20, 2025, from https://checkandconnect.umn.edu/explore/sei

Watson, J. B. (1913). Psychology as the behaviorist views it. Psychological review, 20(2), 158.

Werbach, K., & Hunter, D. (2015). The Gamification Toolkit: Dynamics, Mechanics, and Components for the Win. University of Pennsylvania Press.

World Bank. (2025, April). Taxing Times: South Asia Development Update (April 2025).

International Bank for Reconstruction and Development / The World Bank. https://doi.org/10.1596/978-1-4648-2230

Wouters, P., Van Nimwegen, C., Van Oostendorp, H., & Van Der Spek, E. D. (2013). A meta- analysis of the cognitive and motivational effects of serious games. Journal of Educational Psychology, 105(2), 249–265. https://doi.org/10.1037/a0031311

WWC | Handbooks and Other Resources. (2020). Retrieved June 24, 2025, from https://ies.ed.gov/ncee/wwc/handbooks

Xi, N., & Hamari, J. (2019). Does gamification satisfy needs? A study on the relationship between gamification features and intrinsic need satisfaction. International Journal of Information Management, 46, 210–221. https://doi:10.1016/j.ijinfomgt.2018.12.002

Zhang, Qi, and Zhonggen Yu. (2022) "Meta-Analysis on Investigating and Comparing the Effects on Learning Achievement and Motivation for Gamification and Game-Based Learning." Education Research International, vol. 2022, Aug. 2022, pp. 1–19. https://doi.org/10.1155/2022/1519880.

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