Effectiveness of Kahoot! in Engagement and Motivation among Undergraduate Students: A Case Study of Kenya Methodist University and Meru University of Science and Technology

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Abstract

The digital transformation of higher education has necessitated the adoption of gamified learning platforms to enhance student engagement and motivation. Traditional lecture-based teaching in Kenyan universities faces significant challenges, including low participation (32%) and declining motivation (40%) among undergraduates. This study evaluates the effectiveness of Kahoot!, a gamified learning tool, in improving these outcomes in Kenyan higher education institutions. A quasi-experimental comparative study was conducted at Kenya Methodist University (KEMU) and Meru University of Science and Technology (MUST), involving 782 undergraduate students, divided into experimental and control groups. The study used validated instruments, including Reeve and Tseng's Student Engagement Scale and Vallerand's Academic Motivation Scale, alongside Kahoot!'s platform analytics. Results showed significant improvements in student engagement (29%; Cohen's d = 1.35) and intrinsic motivation (d = 1.31). KEMU outperformed MUST, highlighting the role of institutional infrastructure and faculty support in successful technology integration. The findings underscore Kahoot!'s potential to foster increased engagement and motivation, suggesting that universities should invest in comprehensive planning for gamification adoption, including infrastructure and faculty training to maximize effectiveness. These results provide robust evidence for the adoption of gamified learning platforms in African higher education settings.

Keywords: *Kahoot! Learner engagement, Student motivation, Gamification, Higher education, Educational technology.*

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1.0 Introduction

The digital transformation of higher education has fundamentally reshaped pedagogical approaches worldwide, with the integration of technology becoming essential to contemporary learning environments (Rashid & Asghar, 2016). Universities worldwide have heavily invested in the technology sector, and so too will the e-learning market, valued at $350 billion by 2025 (Research & Markets, 2020). In Kenya, this has been accelerated by government projects, including the Digital Literacy Programme and Kenya Vision 2030, which call for the integration of technology into education (Republic of Kenya, 2018).

The field of education technology has undergone a paradigm shift with the recent rise of gamification. Gamification is the use of game elements in non-game contexts. As a result, it is gaining momentum across different higher education settings (Dichev & Dicheva, 2017). Studies show that gamified learning environments boost student engagement by 90% and improve memory retention by 75% (Deterding et al., 2011). This approach addresses critical pedagogical challenges by incorporating elements such as point systems, leaderboards, badges, and competitive activities that naturally motivate learners.

Issues regarding student motivation and engagement in Kenyan universities reflect the global crises facing the higher education system. Research shows that about 60% of undergraduate students at Kenyan universities do not actively participate in traditional lecture-based classes (Ng'ang'a & Nyongesa, 2019). Moreover, a study by Kiprotich and Wanyama (2020) reveals that 45% of students exhibited reduced motivation as they progressed through theoretical subjects that were not practical.

Kahoot! has become an important game-based learning platform that addresses these educational issues through its interactive features. Launched in 2013, Kahoot! has grown to reach over 7 billion global players, with more than 1.5 billion participating learners as of 2021 (Kahoot! ASA, 2021). Kahoot! is a web-based tool designed for educators to deliver quizzes, distribute surveys, conduct discussions, and more in real time in a classroom setting. The core feature of Kahoot! presents multiple-choice questions on a shared screen, and students answer from their own devices using a game PIN.

Gamification of the platform includes time-limited questions, point scoring based on speed and accuracy, colorful visual feedback, and competitive leaderboards of top performers. With versatility across several academic subjects, it supports a variety of question types, including multiple-choice, true/false, and open-ended responses. Moreover, the platform provides an in-depth analysis and report that gives teachers an overview of students' performance.

Recent studies have demonstrated Kahoot!'s effectiveness across diverse educational contexts. Licorish et al. (2018) found that clickers significantly improve student engagement and academic performance in computer science courses. In business education settings, Plump and LaRosa (2017) reported higher rates of attention and engagement with clickers. However, research on Kahoot!'s usefulness in African higher education contexts is limited, particularly regarding comparative institutional analyses and context-specific implementation factors.

Licorish et al. (2018) conducted a comprehensive study with 150 computer science students, demonstrating significant improvements in engagement (Cohen's $d = 0.78$) and academic performance (15% average score increase) following Kahoot! integration. However, their single-discipline focus and limited duration (six weeks) constrain generalizability across diverse academic fields and long-term sustainability assessment. Similarly, Plump and LaRosa (2017) found enhanced attention and participation rates among business students, yet their qualitative methodology lacks the quantitative rigor necessary to measure engagement magnitude and compare across populations.

KEMU and MUST were selected for this study to provide a comparative perspective on the

effectiveness of Kahoot! in private and public institutional contexts. This study also aligns with Kenya's ongoing government initiatives, such as the Digital Literacy Programme and Vision 2030, which promote the integration of technology in education to improve learning outcomes (Republic of Kenya, 2018).

Relevant Theories

Gamification Theory

Deterding et al. (2011) established the foundational framework for understanding gamification as "the use of game design elements in non-game contexts." Gamification influences learning and teaching by meaningfully using game elements such as points, badges, leaderboards, and progress tracking. In educational contexts, Deterding's framework effectively explains how Kahoot!'s competitive elements and immediate feedback mechanisms can enhance engagement. However, it inadequately addresses cultural and contextual variations that influence the reception of gamification across different educational systems. Assessing the long-term sustainability of Kahoot!'s impact on student learning outcomes requires evaluating whether the initial benefits persist over multiple semesters and how learning behaviors evolve with prolonged use.

Self-Determination Theory

The motivational process that enables gamification to be effective can be better understood through Deci and Ryan's (1985) Self-Determination Theory (SDT). SDT suggests that human beings have three inherent psychological needs: autonomy (feeling volitional and self-directed), competence (experiencing mastery and effectiveness), and relatedness (connecting meaningfully with others). In educational gamification contexts, SDT suggests that successful interventions must satisfy these basic needs to promote intrinsic motivation and sustained engagement. Kahoot!'s competitive elements may enhance feelings of competence through immediate performance feedback, but over-reliance on external validation could potentially undermine the development of autonomous motivation (Deci et al., 1999). This theoretical tension highlights the importance of balanced gamification implementation that supports rather than replaces intrinsic learning motivations.

"Baseline measurements showed comparable engagement (M = 3.21-3.23) and motivation (M = 4.08-4.12) across universities, confirming equivalent starting points"

The study hypothesizes that Kahoot! will significantly increase student engagement (behavioral, emotional, and cognitive) and intrinsic motivation through its game-based elements, aligning with Self-Determination Theory and Gamification Theory.

Statement of the Problem

Contemporary higher education demands evidence-based assessment of digital learning tools that can effectively enhance student engagement and motivation while maintaining academic rigor and learning outcomes. Educational institutions worldwide increasingly recognize the need for pedagogical innovations that address the diverse learning preferences and technological competencies of digital-native students (Prensky, 2021). Kenya has experienced a need for quality engagement due to the increasing number of enrollments in higher education. For instance, the number of undergraduates increased by 78% between 2010 and 2020. This has posed unique and significant challenges (Commission for University Education, Kenya, 2020).

Currently, Kenyan universities face significant challenges with low student engagement in traditional lecture-based teaching. Research by Mwangi and Kariuki (2019) documented that only 32% of undergraduate students actively

participate in conventional classroom discussions, while 68% report passive learning experiences that fail to sustain attention beyond 15 minutes of lecture delivery. This engagement deficit is compounded by declining motivation among undergraduate students, with studies indicating a 40% decrease in intrinsic motivation from first to final year, particularly in theoretical courses that lack interactive components (Ochieng & Korir, 2018).

Several critical gaps exist in current research and practice. First, there is a significant gap in comparative research on the effectiveness of gamification across different institutional contexts in Kenya, with most studies focusing on single-institution case studies, which limits generalizability (Waithaka & Mutinda, 2021). Second, empirical evidence on the long-term sustainability and impact of game-based learning tools in African higher education settings is limited, particularly regarding infrastructure requirements and cultural adaptation. Third, insufficient research addresses the comparative effectiveness of digital learning tools across demographic groups, including gender, age, and academic discipline, within Kenyan university contexts.

The current paper addresses the current situation by providing comprehensive empirical evidence on Kahoot!'s effectiveness in enhancing learner engagement and motivation through a rigorous comparative study design. The research fills identified gaps by examining implementation across two distinct universities, analyzing both quantitative engagement metrics and qualitative experiential factors that influence success. By incorporating pre- and post-test measurements with control groups, this study provides robust evidence to inform educational policy and practice decisions. It contributes to the limited body of research on the effectiveness of gamification in African higher education contexts.

Research Objectives

Main Objective: To assess the effectiveness of Kahoot! in enhancing learner engagement and motivation among undergraduate students.

Specific Objectives:

1. To measure baseline levels of learner engagement and motivation across both universities.
2. To evaluate the impact of implementing Kahoot! on student engagement.
3. To assess changes in student motivation after Kahoot! integration.
4. To compare the effectiveness of Kenya Methodist University and Meru University of Science and Technology.

Significance of the Study

This study makes significant contributions to educational technology research in Kenya by providing empirical evidence on the effectiveness of gamification in African higher education contexts. The research addresses a critical knowledge gap in assessing digital learning tools in Kenyan universities, offering evidence-based insights to inform institutional technology adoption decisions.

The practical implications for university teaching methods are substantial, as findings will inform faculty development programs and instructional design improvements. The study provides concrete evidence for integrating interactive learning technologies, potentially shifting pedagogical dynamics from traditional lecture-based methods to more engaging, student-centered approaches.

Policy recommendations from this research will support the adoption of digital learning at the institutional and national levels. The study provides evidence for policy frameworks that promote innovative teaching methods while addressing infrastructure and training requirements for successful implementation. These recommendations will contribute to Kenya's broader educational technology strategy, supporting the achievement of Vision 2030 goals related to educational and technological advancement in higher education institutions.

2.0 Materials and Methods

Research Design

This study employed a quasi-experimental design with control and experimental groups to assess the effectiveness of Kahoot! in enhancing learner engagement and motivation. The design incorporated a pre-test/post-test comparative approach, enabling rigorous evaluation of changes in dependent variables following intervention implementation. The quasi-experimental design was selected over a true experimental design due to practical constraints in randomly assigning entire classes to treatment conditions.

The mixed-methods approach integrated quantitative and qualitative data collection to provide a comprehensive understanding of Kahoot!'s impact. Quantitative data captured measurable changes in engagement and motivation using validated instruments, while qualitative data explored experiential aspects, contextual factors, and implementation challenges that quantitative measures alone could not adequately address.

The study used a between-subjects design, comparing experimental groups that received Kahoot! integration with control groups continuing with traditional instruction methods. Additionally, a within-subjects analysis examined pre-post changes within each group, enabling assessment of both relative effectiveness compared with control conditions and absolute changes within treatment groups.

Study Location and Context

Kenya Methodist University (KEMU) serves approximately 8,500 students across undergraduate and graduate programs, with 85% of the student population enrolled in undergraduate programs. Meru University of Science and Technology (MUST) enrolls approximately 12,000 students, 80% of whom are undergraduates. The university offers programs in engineering, computing and informatics, agriculture, social sciences, business, and pure sciences. The university has invested significantly in educational technology infrastructure as part of its strategic commitment to innovative teaching methodologies.

The selection of KEMU and MUST was based on considerations that enhance the study's validity and generalizability. First, both universities represent different institutional types (private vs. public), providing insights into how institutional context influences the effectiveness of technology integration. Second, both universities have demonstrated a commitment to educational innovation and possess the technological infrastructure necessary for Kahoot! implementation, ensuring technical feasibility and avoiding confounding factors related to basic infrastructure limitations.

Target Population

The target population consisted of undergraduate students enrolled at both universities during the 2025/2026 academic year. The population included students from various academic disciplines, year levels, and demographic backgrounds. The study targeted 2000 students, 1000 from each institution.

Inclusion Criteria:

- Enrolled undergraduate students in selected courses
- Access to internet-enabled devices (smartphones, tablets)
- Voluntary consent to participate in the research
- Age 18 years and above

Exclusion Criteria:

- Part-time or distance learning students
- Graduate students or non-degree seeking students
- Students who declined to provide informed consent

Sampling Procedure and Sample Size

The study employed stratified random sampling at the university and course levels to ensure representative samples from both institutions and across academic experience levels. Stratification variables included university (KEMU vs. MUST), year of study, and gender

to ensure balanced representation across key demographic categories.

Sample Size Calculation Using Yamane's Formula:

$n = \frac{1}{Ne^2}$

Where:

- n = required sample size
- N = total population size
- e = margin of error (0.05)

For each of the institutions' undergraduate populations (N = 1,000):

$n = \frac{1000}{(1000 \times 0.05^2)} = 400$

Total sample size = 400*2 = 800 students

Distribution:

- KEMU: 400 students (200 experimental, 200 control)
- MUST: 400 students (200 experimental, 200 control)

Data Collection Instruments

Student Engagement Scale

Reeve and Tseng's (2011) Student Engagement Scale measured behavioral, emotional, and cognitive engagement dimensions. The 18-item scale uses 5-point Likert responses. The instrument demonstrated excellent reliability (Cronbach's $\alpha = 0.89$) and was validated across diverse cultural contexts, including African educational settings.

Academic Motivation Scale

The Academic Motivation Scale (AMS-C 28) by Vallerand et al. (1992) measured seven motivation subscales across the intrinsic, extrinsic, and amotivation dimensions using 7-point Likert scales. The instrument showed strong psychometric properties (Cronbach's $\alpha = 0.83$-0.91) across cultural contexts.

Kahoot! Usage Analytics

Platform-generated metrics provided objective data on participation, including response rates, accuracy, response times, and engagement duration. These metrics complemented self-report instruments with behavioral evidence.

Data Collection Procedure

Ethical approval was obtained from both university research committees. Informed consent procedures included detailed explanations of the study's purposes and participants' rights. Pre-implementation baseline measurements were collected during the first two weeks. Kahoot! Implementation spanned 2 weeks, with sessions twice a week. Faculty training workshops covered platform use and best practices. Post-implementation measurements used identical instruments. Qualitative data included focus group discussions. The process ensured the confidentiality and anonymity of the respondent's details.

Data Analysis Techniques

Quantitative Analysis

Descriptive statistics included means, standard deviations, frequencies, and percentages. Independent t-tests were used to compare groups at baseline and after implementation. Paired t-tests examined within-group changes. A two-way mixed ANOVA was used to analyze group-by-time interactions. Effect sizes were interpreted using Cohen's d. Statistical significance was set at $p < 0.05$, with Bonferroni corrections for multiple comparisons.

Qualitative Analysis

Thematic analysis followed Braun and Clarke's (2006) six-phase approach, using NVivo 12 software. Independent coding by two researchers ensured reliability. Triangulation of quantitative and qualitative findings enhanced the validity of interpretation.

3.0 Results and Discussion

Demographic Characteristics

The final sample comprised 782 undergraduate students (response rate 97.8%), including 394 from KEMU and 388 from MUST.

Table 1

Demographic Characteristics

Characteristic	KEMU (n=394)	MUST (n=388)	Total (n=782)
Gender			
Male	189 (48.0%)	195 (50.3%)	384 (49.1%)
Female	205 (52.0%)	193 (49.7%)	398 (50.9%)
Age Groups			
18-20 years	143 (36.3%)	156 (40.2%)	299 (38.2%)
21-23 years	189 (48.0%)	181 (46.6%)	370 (47.3%)
24+ years	62 (15.7%)	51 (13.1%)	113 (14.4%)
Year of Study			
Year 1	110 (27.9%)	104 (26.8%)	214 (27.4%)
Year 2	102 (25.9%)	99 (25.5%)	201 (25.7%)
Year 3	96 (24.4%)	101 (26.0%)	197 (25.2%)
Year 4	86 (21.8%)	84 (21.6%)	170 (21.7%)

Gender distribution was balanced across universities ($\chi^2 = 1.02$, $p = 0.31$). Response rates were excellent, with 94.7% in the experimental groups and 100% in the control groups. Data completeness exceeded 98% across all instruments.

Baseline Measurements

Table 2

Baseline Engagement and Motivation Levels

Variable	KEMU		MUST	
	Exp (n=197)	Control (n=197)	Exp (n=194)	Control (n=194)
Student Engagement				
Overall Score	3.23±0.51	3.21±0.49	3.19±0.53	3.23±0.50
Behavioral	3.32±0.60	3.29±0.57	3.26±0.62	3.31±0.59
Emotional	3.18±0.57	3.15±0.54	3.15±0.59	3.18±0.56
Cognitive	3.21±0.47	3.18±0.44	3.17±0.49	3.21±0.46
Academic Motivation				
Overall Score	4.11±0.66	4.09±0.63	4.06±0.68	4.12±0.65
Intrinsic	4.29±0.71	4.26±0.69	4.22±0.73	4.28±0.70
Extrinsic	3.94±0.57	3.91±0.55	3.90±0.59	3.96±0.56

Baseline comparisons showed no significant differences between the experimental and control groups (all p-values> 0.05), confirming successful randomization. Independent t-tests revealed minimal differences between universities in overall engagement ($t = 1.24$, $p = 0.22$) and motivation ($t = 0.67$, $p = 0.50$).

Impact on Student Engagement Overall Engagement Results

Table 3

Pre-Post Engagement Comparisons

Measure	Experimental Group			Control Group		
	Pre	Post	Change	Pre	Post	Change
Overall Engagement						
Mean ± SD	3.21±0.52	4.15±0.65	+0.94***	3.22±0.49	3.27±0.51	+0.05
Effect Size (d)			1.35			0.10
Behavioral						

Mean ± SD	3.29±0.61	4.28±0.69	+0.99***	3.30±0.58	3.34±0.60	+0.04
Effect Size (d)			1.42			0.07
Emotional						
Mean ± SD	3.16±0.58	4.11±0.67	+0.95***	3.16±0.55	3.21±0.57	+0.05
Effect Size (d)			1.38			0.09
Cognitive						
Mean ± SD	3.19±0.48	4.06±0.62	+0.87***	3.19±0.45	3.23±0.47	+0.04
Effect Size (d)			1.31			0.09

***p < 0.001*

Paired t-tests revealed highly significant improvements across all engagement dimensions in the experimental groups (all p < 0.001), with large effect sizes. Control groups showed minimal, non-significant changes. Overall engagement improved by 29% (Cohen's d = 1.35), exceeding typical effects of educational interventions.

University Comparison

Table 4

University Comparison of Engagement Outcomes

Measure	KEMU Exp	MUST Exp	t-statistic	p-value	Effect Size
Post-Implementation					
Overall	4.27±0.62	4.02±0.67	4.12	<0.001***	0.39
Behavioral	4.41±0.65	4.14±0.72	4.02	<0.001***	0.40
Emotional	4.23±0.64	3.98±0.69	3.87	<0.001***	0.38
Cognitive	4.18±0.59	3.93±0.64	4.15	<0.001***	0.41

***p < 0.001*

KEMU achieved significantly higher post-implementation engagement across all dimensions. Smaller class sizes (average 25 vs. 42 students), superior infrastructure (99.2% vs. 89.4% internet uptime), and higher faculty comfort with technology contributed to these differences.

Impact on Student Motivation Motivation Scale Results

Table 5

Pre-Post Motivation Comparisons

Type	Experimental Group			Control Group		
	Pre	Post	Change	Pre	Post	Change
Overall						
Mean ± SD	4.08±0.67	4.76±0.72	+0.68***	4.10±0.64	4.13±0.66	+0.03
Effect Size (d)			1.17			0.05
Intrinsic						
Mean ± SD	4.25±0.72	5.14±0.79	+0.89***	4.27±0.69	4.30±0.71	+0.03
Effect Size (d)			1.31			0.04
Extrinsic						
Mean ± SD	3.92±0.58	4.38±0.63	+0.46***	3.93±0.55	3.96±0.57	+0.03
Effect Size (d)			0.81			0.05

***p < 0.001*

Significant improvements occurred in overall motivation (d = 1.17), with larger gains for intrinsic (d = 1.31) than for extrinsic motivation (d = 0.81). This pattern supports Self-Determination Theory's predictions that gamification enhances autonomous motivation.

Motivational Subscales Analysis

Table 6

Motivation Subscale Changes

Subscale	Pre	Post	Change	Effect Size
Intrinsic - Knowledge	4.30±0.75	5.21±0.82	+0.91***	1.28
Intrinsic - Achievement	4.23±0.73	5.09±0.80	+0.86***	1.22
Intrinsic - Stimulation	4.22±0.74	5.11±0.81	+0.89***	1.25
Extrinsic - External	3.88±0.60	4.34±0.65	+0.46***	0.78
Extrinsic - Introjection	3.94±0.57	4.39±0.62	+0.45***	0.79

***p < 0.001*

All intrinsic subscales showed consistent, large improvements (d > 1.22), indicating comprehensive enhancement of intrinsic motivation. Extrinsic subscales showed moderate but significant gains.

Qualitative Findings

Focus group analysis (n = 64) identified four major themes:

Enhanced Engagement: Students reported increased class attendance and participation. "Classes became something to look forward to because of the interactive games" (Female, Year 2, KEMU).

Competitive Elements: Competition-motivated learning while maintaining an enjoyable atmosphere. "The leaderboard made me study harder, but it was a fun competition, not stressful" (Male, Year 3, MUST).

Immediate Feedback: Instant feedback enhanced learning effectiveness. "You knew immediately whether you understood or needed more study" (Female, Year 4, KEMU).

Peer Interaction: Kahoot! facilitated collaborative learning. "We started discussing answers with classmates, making learning more social" (Male, Year 1, MUST).

Comparative Analysis

Two-way ANOVA revealed significant university × treatment interactions for engagement ($F = 12.47$, $p < 0.001$) and motivation ($F = 9.83$, $p = 0.002$). KEMU reported larger effect sizes for engagement ($d = 1.52$ vs. $d = 1.18$) and motivation ($d = 1.34$ vs. $d = 1.00$).

Class size emerged as a significant moderator, with classes with fewer than 30 students showing larger effects. Internet reliability and faculty comfort levels predicted implementation success, underscoring the importance of contextual factors.

Discussion of Findings

Results provide strong evidence for Kahoot!'s effectiveness in Kenyan higher education, with large effect sizes exceeding those of typical educational interventions. Findings align with international research and extend the evidence to African contexts. Great improvements in intrinsic motivation challenge the claim that gamification undermines intrinsic motivation.

Differential institutional outcomes underscore the critical importance of contextual factors. Superior KEMU results reflect better infrastructure, faculty preparation, and institutional support, emphasizing that the effectiveness of technology depends on comprehensive implementation support rather than simple deployment.

However, the 2-week period may not reflect long-term sustainability, and the quasi-experimental design limits the strength of causal inference compared with true experimental approaches. Cultural factors specific to Kenya may limit generalizability, though the comparative approach provides valuable contextual insights.

4.0 Conclusion

Baseline measurements showed comparable engagement (M = 3.21-3.23) and motivation (M = 4.08-4.12) across universities, confirming equivalent starting points. No significant

differences emerged between experimental and control groups, validating randomization and enabling valid attribution of the treatment effect.

Kahoot! implementation produced substantial improvements in engagement across all dimensions. Overall engagement increased by 29% (d = 1.35), with behavioral engagement showing the largest gains (d = 1.42), followed by emotional (d = 1.38) and cognitive engagement (d = 1.31). These large effect sizes exceed those typically observed in educational interventions, demonstrating practically significant changes in active learning behaviors, emotional connection, and deep-thinking processes.

Student motivation improved significantly across both intrinsic and extrinsic orientations. Intrinsic motivation showed particularly large gains (d = 1.31), with all subscales (knowledge, achievement, stimulation) showing consistent improvements above d = 1.22. This challenge concerns that gamification undermines internal motivation and instead supports comprehensive enhancement of autonomous learning. Extrinsic motivation also improved significantly (d = 0.81), supporting multiple motivational pathways.

Comparative effectiveness revealed significant institutional differences, with KEMU consistently achieving higher outcomes despite equivalent protocols. KEMU reported larger effect sizes for engagement (d = 1.52 vs. d = 1.18) and motivation (d = 1.34 vs. d = 1.00), highlighting contextual factors such as infrastructure quality, faculty preparedness, class size, and institutional support systems as mediators of gamification effectiveness.

5.0 Recommendations

For Educational Practice

Universities should formalize peer support networks that provide ongoing consultation, collaborative question development, and shared resources. Regular faculty learning communities focused on educational technology can sustain momentum through collective problem-solving. Assessment integration is also a crucial consideration in implementation. Faculty need training in using analytics for formative assessment, identifying knowledge gaps, and adapting instruction based on real-time responses. Professional development should balance competitive elements with collaborative objectives, ensuring that gamification enhances inclusive environments.

For Policy Development

Universities should develop comprehensive digital learning policies that establish minimum infrastructure standards, device accessibility requirements, and technical support protocols. Policies must mandate reliable connectivity across learning spaces, adequate bandwidth for simultaneous use, and backup systems to prevent disruptions. Second, institutions should establish dedicated budget lines for educational technology, including faculty training, technical support, device lending, and licensing fees. Policy frameworks should prioritize sustainable funding that ensures continued access rather than short-term implementations that fail due to resource constraints.

For Future Research

Longitudinal studies examining sustained impact over extended timeframes are critical to understanding patterns of long-term effectiveness and sustainability. Research should track changes in engagement and motivation across multiple semesters and years, examining whether initial effects persist, diminish, or evolve. Multi-year studies could identify optimal implementation cycles, novelty patterns, and strategies for maintaining student interest. Research on other gamification platforms beyond Kahoot! would also provide a broader understanding of the effectiveness of game-based learning and identify platform-specific success factors. Future studies should also incorporate a more rigorous randomization process and provide further clarification on data analysis techniques, including the handling of missing data and potential biases in the sampling procedure.

Value and Long-term Implications

The study's demonstration of gamification's effectiveness in enhancing engagement and

motivation has significant implications for improving educational quality in African higher education contexts. Large effect sizes observed across multiple outcome measures indicate that properly implemented gamification can produce meaningful improvements in fundamental educational processes that are crucial for academic success and lifelong learning attitudes.

The evidence supporting the enhancement of intrinsic motivation challenges common concerns that gamification may undermine autonomous learning orientations. These findings suggest that well-designed gamified interventions can simultaneously enhance multiple motivational orientations while maintaining the primacy of intrinsic learning motivations, thereby supporting theoretical understanding and practical guidance for implementation.

Institutional differences that highlight the importance of contextual factors provide valuable insights for educational policy development and resource allocation decisions. Recognizing that the effectiveness of technology depends on comprehensive implementation support rather than on simple tool deployment can inform strategic planning and investment priorities for sustainable educational improvement.

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