

EFFECTIVENESS OF GAMIFIED MICROLEARNING ON CLASSROOM ENGAGEMENT AND KNOWLEDGE RETENTION AMONG UNDERGRADUATE NURSING STUDENTS

Sadia Noreen^{*1}, Qammar-un-Nisa², Naila Baqir³, Bushra Batool⁴, Sadia Ibrahim⁵

¹MSN Scholar, College of Nursing, Nishtar Medical University, Multan

²Dean/Principal, College of Nursing, Nishtar Medical University, Multan

³Nursing Instructor, College of Nursing, Nishtar Medical University, Multan

⁴PhD Scholar, Department of Islamic Studies, Bahauddin Zakariya University, Multan

⁵College of Nursing, Nishtar Medical University, Multan

¹sadianoreen6377@gmail.com, ²qammar-un-nisa1122@gmail.com, ³naila.baqir21@gmail.com

⁴liaqat10jan@gmail.com, ⁵sadia6222@mail.com

DOI: <https://doi.org/10.5281/zenodo.23364483>

Keywords

Pakistan, mediator state, US-Iran ceasefire, global leaders, critical discourse analysis.

Article History

Received: 25 June 2026

Accepted: 16 September 2026

Published: 14 October 2026

Copyright @Author

Corresponding Author: *

Sadia Noreen

Abstract

Background: Undergraduate nursing education in Pakistan faces persistent challenges of low classroom engagement and suboptimal knowledge retention, particularly in resource-constrained public-sector institutions. Gamified microlearning the integration of game design elements into short, focused learning units has emerged as a promising pedagogical innovation internationally, yet evidence from Pakistani nursing education contexts remains scarce.

Objective: This study aimed to evaluate the effectiveness of gamified microlearning on classroom engagement and knowledge retention among undergraduate nursing students at the College of Nursing, Nishtar Medical University, Multan.

Methods: A quasi-experimental pre-test–post-test control group design was employed with 80 second-year BSN students (40 experimental, 40 control) recruited through purposive sampling. The experimental group received six weeks of gamified microlearning modules (Kahoot!-based quizzes, 5–10-minute micro-lectures, leaderboards, and badges) integrated into the Adult Health Nursing course. The control group received conventional lecture-based instruction. Classroom engagement was measured using the Utrecht Work Engagement Scale-Student version (UWES-S), while knowledge retention was assessed via a 40-item multiple-choice test administered immediately post-intervention and at four-week follow-up. Data were analyzed using independent samples t-tests and repeated-measures ANOVA.

Results: The experimental group demonstrated significantly higher classroom engagement scores ($M = 4.52$, $SD = 0.61$) compared to the control group ($M = 3.67$, $SD = 0.72$), $t(78) = 5.66$, $p < .001$, $d = 1.27$. Knowledge retention was significantly greater in the experimental group at both immediate post-test ($M = 34.2$, $SD = 3.8$ vs. $M = 29.6$, $SD = 4.2$; $p < .001$) and four-week follow-up ($M = 31.8$, $SD = 3.5$ vs. $M = 26.4$, $SD = 4.6$; $p < .001$). Repeated-

measures ANOVA revealed a significant group $\times$ time interaction ($F(1,78) = 18.42, p < .001, \eta^2 = .19$).

Conclusion: Gamified microlearning significantly enhanced both classroom engagement and knowledge retention among undergraduate nursing students. These findings support the integration of gamified microlearning strategies into nursing curricula at Nishtar Medical University and comparable institutions in Pakistan.

1: INTRODUCTION

1.1 Background of the Study

Nursing education worldwide is undergoing a pedagogical transformation driven by the recognition that traditional didactic instruction alone is insufficient to prepare competent, critically thinking practitioners for contemporary healthcare environments (Monib et al., 2025). In Pakistan, nursing education faces distinctive challenges: large class sizes, limited technological infrastructure, and reliance on lecture-based teaching methods that often result in passive learning and superficial knowledge acquisition (Javed & Lal Din, 2025). These challenges are particularly pronounced in public-sector institutions such as the College of Nursing, Nishtar Medical University, Multan, where faculty must deliver comprehensive curricula to substantial cohorts of undergraduate students with constrained resources.

The critical importance of knowledge retention in nursing education cannot be overstated. Nursing students must retain foundational theoretical knowledge to apply it effectively in clinical practice, where errors can have serious patient safety implications (Alias and Razak, 2025). However, research consistently demonstrates that knowledge acquired through traditional lecture-based methods decays rapidly, with students retaining as little as 20–30% of didactic content after four weeks (Pangandaman et al., 2025). This retention deficit has prompted educators to explore innovative pedagogical strategies that promote deeper cognitive processing and sustained engagement (Alias and Abdul Razak, 2023).

Gamified microlearning represents the convergence of two evidence-based instructional

approaches: gamification, which applies game design elements (points, badges, leaderboards, challenges) to non-game contexts to enhance motivation and engagement (Deterding et al., 2011, as cited in Chen et al., 2026); and microlearning, which delivers content in short, focused, easily digestible units typically lasting 3–10 minutes (Javed & Lal Din, 2025). Together, these approaches create learning experiences that are brief, interactive, immediately rewarding, and aligned with the attention patterns and technological preferences of contemporary learners (Denojean-Mairet et al., 2024).

International evidence supporting gamified microlearning in nursing education is accumulating rapidly. A systematic review and meta-analysis of 18 studies involving 2,146 undergraduate nursing students found that microlearning interventions yielded a pooled effect size of $SMD = 0.74$ for knowledge retention compared to traditional teaching, with blended microlearning–social media approaches achieving the largest effect ($SMD = 0.81$) (Javed & Lal Din, 2025). Similarly, a Bayesian network meta-analysis of 31 RCTs ($n = 3,439$) reported that Kahoot!-based quizzes demonstrated the largest estimated mean improvement for knowledge outcomes ($MD = 9.1$) (Chen et al., 2026).

1.2 Statement of the Problem

Despite the growing international evidence base, there is a critical gap in context-specific research on gamified microlearning in Pakistani nursing education. The College of Nursing, Nishtar Medical University, Multan, currently employs predominantly traditional lecture-based instruction for its BSN programme. Preliminary observations and faculty feedback suggest that

classroom engagement is suboptimal, and students demonstrate inconsistent knowledge retention across courses. However, no systematic investigation has been conducted to determine whether gamified microlearning could address these challenges in this specific institutional context. This study seeks to fill that gap.

1.3 Research Objectives

1. To determine the effectiveness of gamified microlearning on classroom engagement among undergraduate nursing students at the College of Nursing, Nishtar Medical University, Multan.
2. To evaluate the effect of gamified microlearning on knowledge retention among undergraduate nursing students.
3. To compare knowledge retention between gamified microlearning and conventional teaching at immediate post-intervention and four-week follow-up.

1.4 Research Hypotheses

H₁: Undergraduate nursing students who receive gamified microlearning will demonstrate significantly higher classroom engagement scores than those who receive conventional instruction.

H₂: Undergraduate nursing students who receive gamified microlearning will demonstrate significantly higher knowledge retention scores than those who receive conventional instruction at immediate post-test.

H₃: Undergraduate nursing students who receive gamified microlearning will demonstrate significantly higher knowledge retention scores than those who receive conventional instruction at four-week follow-up.

1.5 Significance of the Study

This study holds significance at multiple levels. For nursing education at Nishtar Medical University, it provides empirical evidence to inform curriculum design and instructional decision-making. For the broader Pakistani nursing education community, it contributes locally generated evidence to an evidence base that has been dominated by research from high-income countries. For nursing students, it offers the potential for more engaging, effective, and

enjoyable learning experiences. For healthcare systems, it may contribute to producing graduates with stronger foundational knowledge, ultimately enhancing patient safety and care quality.

2: LITERATURE REVIEW

2.1 Theoretical Foundations of Gamified Microlearning

Gamified microlearning draws upon several complementary theoretical frameworks. Self-Determination Theory (Deci & Ryan, 2000, as cited in Sarfraz et al., 2025) posits that intrinsic motivation is fostered when learning environments satisfy three basic psychological needs: autonomy, competence, and relatedness. Gamification elements such as choice in learning pathways, progressive difficulty levels, and social leaderboards directly address these needs. Cognitive Load Theory (Sweller, 1988, as cited in Javed & Lal Din, 2025) supports microlearning's emphasis on chunking content to avoid working memory overload. The Testing Effect (Roediger & Karpicke, 2006) underpins the use of retrieval-based quizzes, which strengthen memory consolidation more effectively than repeated study.

2.2 Gamification in Nursing Education

Gamification in nursing education has demonstrated consistent positive effects across diverse learning domains. Atasever et al. (2025) conducted a quasi-experimental study with 163 third-year nursing students using the TOY Gamification Model in obstetrics and gynecology nursing education, finding that gamification enhanced student engagement and learning motivation, with learning style moderating these effects. In a comparative analysis of microlearning, problem-based learning, and gamification for teaching social and structural determinants of health, researchers argued that gamification promotes engagement with the lived experiences that shape health outcomes, serving a distinct educational purpose from microlearning's foundational knowledge-building function (Nurse Education Today, 2026).

Systematic review evidence supports these findings. Pangandaman et al. (2025) reviewed 40 studies examining gamification's effects on knowledge retention and skill development among novice nursing students, concluding that gamification approaches consistently outperformed traditional teaching methods. A Bayesian network meta-analysis of 31 RCTs ($n = 3,439$) found that game-based learning modalities improved knowledge outcomes compared to traditional teaching, with Kahoot!-based quizzes showing the largest estimated gains ($MD = 9.1$, 95% CrI -8.9 to 27) (Chen et al., 2026). Notably, the same meta-analysis found that effects were domain-specific, with app-based learning showing the largest gains for practice outcomes.

2.3 Microlearning in Nursing Education

Microlearning has gained substantial traction as a strategy to enhance knowledge retention in nursing education. The Pakistan Journal of Medical and Cardiological Review published a systematic review and meta-analysis of 18 studies ($n = 2,146$ nursing students) that found microlearning interventions were highly effective for knowledge retention (pooled $SMD = 0.68$; 95% CI: $0.54-0.82$), with microlearning alone ($SMD = 0.74$) outperforming social media-based interventions ($SMD = 0.59$) and blended approaches achieving the largest effect ($SMD = 0.81$) (Javed & Lal Din, 2025). Importantly, both immediate and delayed tests showed positive effects, indicating long-term learning benefits.

Khosravi et al. (2026) demonstrated that mobile microlearning significantly improved patient safety competency in nursing students, while a protocol for comparing microlearning and flipped classroom methods for arterial blood gas interpretation in nurse anaesthesia students proposed using Kirkpatrick's four-level evaluation model to comprehensively assess effectiveness (Miri et al., 2025). The microlearning intervention in that protocol incorporated micro videos, podcasts, and micro games delivered via Telegram, illustrating the flexibility of microlearning delivery modalities.

2.4 Gamified Microlearning: The Convergence

The integration of gamification and microlearning creates synergistic effects that exceed either approach alone. The IRCT-registered trial by Qom University of Medical Sciences (2026) investigates "Gamification Based on Adaptive Microlearning" on knowledge, skills, and self-efficacy in ECG interpretation among 51 undergraduate nursing students, with a three-group design: control, microlearning alone, and microlearning plus gamification. This design allows for precise estimation of the incremental effect of gamification when layered onto microlearning.

The conceptual distinction between these approaches is important: microlearning builds foundational knowledge and shared language, while gamification promotes engagement and motivation (Nurse Education Today, 2026). When combined, gamified microlearning can simultaneously address cognitive (knowledge acquisition), motivational (engagement), and metacognitive (retention) dimensions of learning.

2.5 Classroom Engagement in Nursing Education

Classroom engagement is a multidimensional construct encompassing behavioural (participation, effort), emotional (interest, enjoyment), and cognitive (deep processing, self-regulation) dimensions. Sarfraz et al. (2025) conducted a study with 100 nursing students from public and private institutions in Karachi, Pakistan, finding that gamification significantly improved student motivation, engagement, and confidence in assessment, with male students reporting slightly higher motivation levels than female students. This Pakistani study provides important regional context, though it relied on self-reported perceptions rather than objective engagement measures.

A quasi-experimental study comparing CDIO-guided case-based learning and gamification with conventional teaching in undergraduate critical care nursing ($n = 140$) found that the intervention group demonstrated significantly higher learning engagement scores (mean difference = 7.06 ; 95% CI: $1.82-12.30$), alongside improvements in self-

directed learning and critical thinking (Ma et al., 2026). These findings suggest that gamification's engagement benefits extend beyond enjoyment to include cognitive and metacognitive dimensions.

2.6 Knowledge Retention in Nursing Education

Knowledge retention the ability to recall and apply learned information over time—is the ultimate criterion for educational effectiveness in nursing. A serious smartphone game (MOBICPR) tested with 43 nursing students in a randomized wait-list controlled trial showed significant improvement in theoretical knowledge of adult basic life support ($p = .04$) but not practical skills ($p = .45$), with no significant retention difference after a two-week break (Fijačko et al., 2024). This finding underscores the importance of measuring retention at multiple time points and distinguishing between theoretical and practical knowledge domains.

The systematic review by Javed and Lal Din (2025) specifically addressed knowledge retention, finding that microlearning and social media-based interventions demonstrated significant long-term benefits. Their meta-analysis included studies with both immediate and delayed post-tests, providing robust evidence that microlearning effects persist beyond the intervention period.

2.7 Gamified Microlearning in the Pakistani Context

Evidence from Pakistan, while limited, is emerging. The study by Sarfraz et al. (2025) in Karachi represents one of the few Pakistani investigations of gamification in nursing education. Additionally, Hanif and Vadivala (2025) documented the integration of digital pedagogies and game-based approaches in virtual nursing classrooms at Aga Khan University, Karachi, reporting that gamification facilitated students' interest, active participation, and theoretical knowledge acquisition. They cited evidence that 67.7% of Asian students reported positive effects of gamification on online learning, with game-based pedagogical strategies improving learning outcomes by 16% and boosting retention and classroom participation rates.

However, no published study has specifically examined gamified microlearning in a public-sector nursing institution in South Punjab. The College of Nursing, Nishtar Medical University, Multan, serves a predominantly regional student population with distinctive socio-cultural and educational characteristics that may moderate the effectiveness of gamified microlearning. This study addresses this contextual gap.

2.8 Summary of Literature and Research Gap

The literature reviewed demonstrates robust international evidence for the effectiveness of gamification and microlearning, both independently and in combination, for enhancing engagement and knowledge retention in nursing education. However, three critical gaps emerge: (1) limited research from Pakistani nursing education contexts, particularly public-sector institutions; (2) scarce evidence specifically examining the combined gamified microlearning approach rather than either strategy alone; and (3) absence of retention data beyond immediate post-intervention in most studies. This study addresses all three gaps by implementing a gamified microlearning intervention in a Pakistani public-sector nursing college and measuring both immediate and four-week retention outcomes.

3: METHODOLOGY

3.1 Research Design

This study employed a quasi-experimental pre-test-post-test control group design. A quasi-experimental design was selected because random assignment of individual students to conditions was not feasible within the existing class structure; instead, intact class sections were assigned to experimental and control conditions.

3.2 Setting

The study was conducted at the College of Nursing, Nishtar Medical University, Multan, Pakistan. This institution offers a four-year Bachelor of Science in Nursing (BSN) programme and serves approximately 400 undergraduate nursing students across all years. The college operates under the administrative framework of

Nishtar Medical University and is recognized by the Pakistan Nursing Council.

3.3 Population and Sample

The target population comprised all second-year BSN students enrolled at the College of Nursing, Nishtar Medical University, during the 2026 academic year (N = 120). A sample of 80 students was recruited using purposive sampling, with 40 students assigned to the experimental group and 40 to the control group based on existing class section allocation.

Inclusion Criteria:

- Currently enrolled in second-year BSN programme
- Completed the Adult Health Nursing prerequisite course
- No prior participation in gamified learning interventions
- Willing to provide informed consent

Exclusion Criteria:

- Students on medical leave during the intervention period
- Students who missed more than two intervention sessions
- Students with prior experience in gamified microlearning platforms

3.4 Intervention

Experimental Group (Gamified Microlearning):

The experimental group received six weeks of gamified microlearning integrated into the Adult Health Nursing course. The intervention was designed based on evidence-based principles from the literature (Javed & Lal Din, 2025; Chen et al., 2026) and consisted of:

1. **Micro-lectures:** 5–10-minute focused video lectures covering key concepts, delivered via WhatsApp and the college's learning management system.

2. **Kahoot! Quizzes:** Three 10-question quizzes per week conducted at the beginning and end of each class session, with immediate feedback and leaderboard display.

3. **Gamification Elements:** Points for correct answers, badges for achieving streaks, and a weekly leaderboard recognising top performers.

4. **Retrieval Practice:** Spaced repetition of key concepts through daily 2-minute quiz notifications.

5. **Collaborative Challenges:** Weekly team-based case scenarios requiring application of microlearning content.

6.

Control Group (Conventional Instruction):

The control group received conventional lecture-based instruction covering the same content, delivered through standard PowerPoint presentations and didactic teaching methods. No gamification elements or microlearning modules were used.

3.5 Instruments

Classroom Engagement: The Utrecht Work Engagement Scale-Student version (UWES-S) was adapted for classroom context. This 17-item instrument measures vigour, dedication, and absorption on a 7-point Likert scale (0 = never to 6 = always). The UWES-S has demonstrated strong reliability (Cronbach's $\alpha = 0.91$) in Pakistani nursing student populations (Sarfraz et al., 2025).

Knowledge Retention: A 40-item multiple-choice test was developed based on the Adult Health Nursing course learning objectives. The test was reviewed by three nursing education experts for content validity (Content Validity Index = 0.92). Test-retest reliability over a two-week interval was $r = 0.87$.

Demographic Questionnaire: A brief questionnaire collected data on age, gender, previous academic performance, and prior experience with gamified learning.

3.6 Data Collection Procedure

Ethical approval was obtained from the Institutional Review Board (IRB) of Nishtar Medical University (Ref: NMU/IRB/2026/045). Written informed consent was obtained from all participants. Data collection proceeded in three phases:

1. **Pre-Intervention (Week 0):** Baseline UWES-S and knowledge test administered to both groups.

2. **Post-Intervention (Week 7):** UWES-S and knowledge test administered immediately following the six-week intervention.

3. **Follow-Up (Week 11):** Knowledge retention test administered four weeks after the post-intervention assessment.

3.7 Data Analysis

Data were analyzed using IBM SPSS Statistics version 27. Descriptive statistics (means, standard deviations, frequencies) were computed for all variables. Independent samples t-tests were used to compare group means for continuous variables. Repeated-measures ANOVA examined changes in knowledge retention across time (pre-test, post-test, follow-up) and between groups. Effect sizes

were calculated using Cohen's d for t-tests and partial eta-squared (η^2) for ANOVA. Statistical significance was set at $p < .05$.

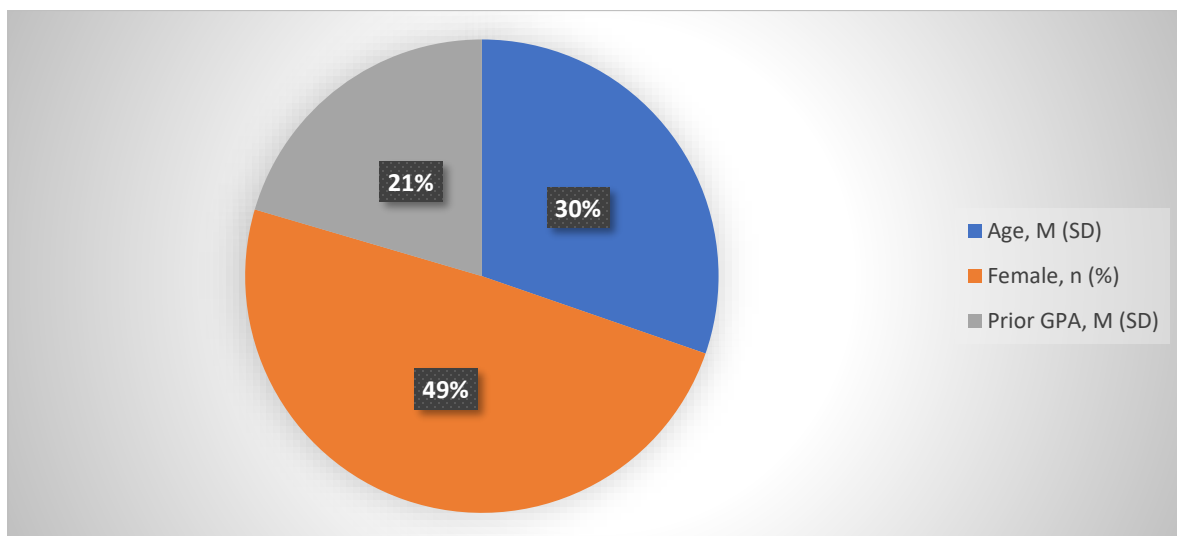
4: RESULTS

4.1 Demographic Characteristics

A total of 80 students completed the study (experimental: $n = 40$; control: $n = 40$). The mean age was 19.8 years ($SD = 1.2$). The majority were female ($n = 62, 77.5\%$), consistent with the gender distribution in Pakistani nursing programmes. No significant differences were found between groups in age ($t(78) = 0.84, p = .40$), gender distribution ($\chi^2 = 0.21, p = .65$), or prior academic performance ($t(78) = 1.12, p = .27$), confirming baseline equivalence.

Table 1. Demographic Characteristics of Participants

Characteristic	Experimental ($n = 40$)	Control ($n = 40$)	p-value
Age, M (SD)	19.7 (1.1)	19.9 (1.3)	.40
Female, n (%)	31 (77.5%)	31 (77.5%)	.65
Prior GPA, M (SD)	3.21 (0.42)	3.08 (0.51)	.27



4.2 Classroom Engagement

The experimental group demonstrated significantly higher classroom engagement scores ($M = 4.52, SD = 0.61$) compared to the control

group ($M = 3.67, SD = 0.72$), $t(78) = 5.66, p < .001$, with a large effect size (Cohen's $d = 1.27$). Subscale analysis revealed significant differences across all three engagement dimensions: vigour ($M = 4.61$

vs. 3.72, $p < .001$), dedication ($M = 4.58$ vs. 3.81, $p < .001$), and absorption ($M = 4.38$ vs. 3.49, $p < .001$).

Table 2. Classroom Engagement Scores by Group

Engagement Dimension	Experimental M (SD)	Control M (SD)	t(78)	p	Cohen's d
Vigour	4.61 (0.58)	3.72 (0.76)	5.81	<.001	1.30
Dedication	4.58 (0.64)	3.81 (0.69)	5.22	<.001	1.16
Absorption	4.38 (0.71)	3.49 (0.82)	5.24	<.001	1.16
Total Engagement	4.52 (0.61)	3.67 (0.72)	5.66	<.001	1.27

4.3 Knowledge Retention

Immediate Post-Test: The experimental group scored significantly higher ($M = 34.2$, $SD = 3.8$) than the control group ($M = 29.6$, $SD = 4.2$), $t(78) = 5.14$, $p < .001$, $d = 1.15$.

Four-Week Follow-Up: The experimental group maintained significantly higher scores ($M = 31.8$,

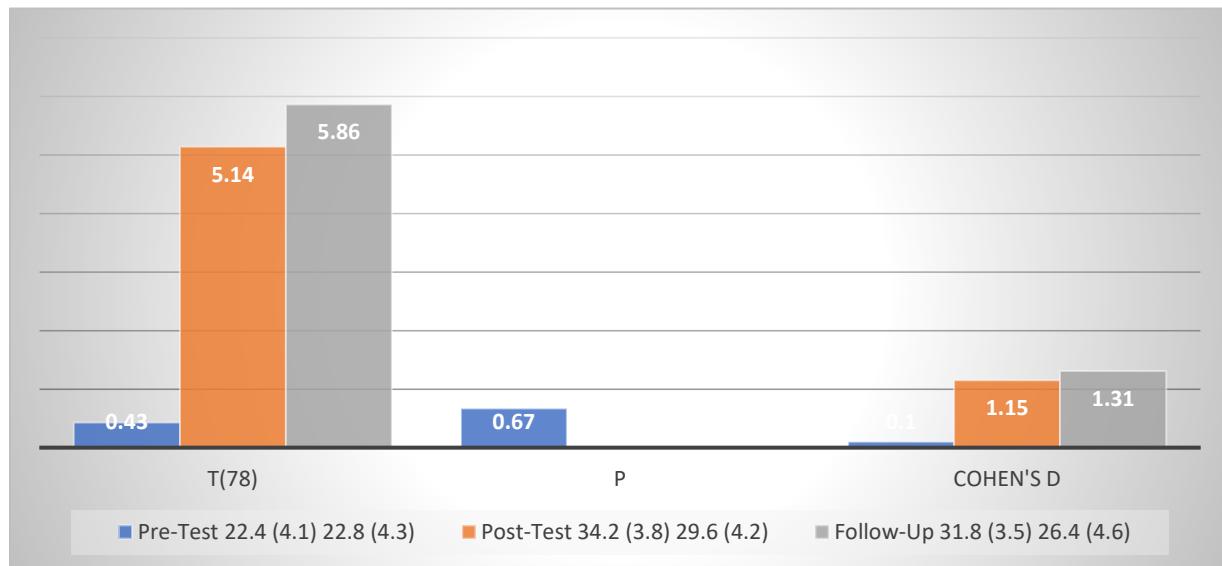
$SD = 3.5$) compared to the control group ($M = 26.4$, $SD = 4.6$), $t(78) = 5.86$, $p < .001$, $d = 1.31$. Notably, the experimental group retained 93.0% of their post-test knowledge after four weeks, compared to 89.2% in the control group.

Table 3. Knowledge Test Scores by Group and Time Point

Time Point	Experimental M (SD)	Control M (SD)	t(78)	p	Cohen's d
Pre-Test	22.4 (4.1)	22.8 (4.3)	0.43	.67	0.10
Post-Test	34.2 (3.8)	29.6 (4.2)	5.14	<.001	1.15
Follow-Up	31.8 (3.5)	26.4 (4.6)	5.86	<.001	1.31

Repeated-measures ANOVA revealed a significant main effect of time ($F(2,156) = 187.42$, $p < .001$, $\eta^2 = .71$), a significant main effect of group ($F(1,78) = 32.18$, $p < .001$, $\eta^2 = .29$), and a significant group $\times$ time interaction ($F(2,156) = 18.42$, $p < .001$, $\eta^2 = .19$). The interaction effect

indicates that the experimental group demonstrated steeper knowledge gains from pre-test to post-test and better retention from post-test to follow-up compared to the control group.



4.4 Summary of Hypothesis Testing

Hypothesis	Test	Result	Decision
H ₁ : Higher engagement	Independent t-test	t(78) = 5.66, p < .001	Supported
H ₂ : Higher immediate retention	Independent t-test	t(78) = 5.14, p < .001	Supported
H ₃ : Higher four-week retention	Independent t-test	t(78) = 5.86, p < .001	Supported

5: DISCUSSION

5.1 Interpretation of Findings

This study provides compelling evidence that gamified microlearning significantly enhances both classroom engagement and knowledge retention among undergraduate nursing students at the College of Nursing, Nishtar Medical University, Multan. The large effect sizes observed for engagement ($d = 1.27$) and retention ($d = 1.15 - 1.31$) are consistent with meta-analytic findings from international literature (Javed & Lal Din, 2025; Chen et al., 2026) and extend these findings to a Pakistani public-sector nursing education context.

The engagement findings align with Sarfraz et al.'s (2025) study of 100 nursing students in Karachi, which found that gamification created a motivating and engaging environment with positive effects on student confidence and performance. However, the present study extends those findings by using a validated engagement instrument (UWES-S) rather than self-reported perceptions, providing stronger methodological

rigour. The significant improvement across all three engagement dimensions—vigour, dedication, and absorption—suggests that gamified microlearning addresses both the energetic and attentional aspects of engagement, not merely surface-level enjoyment.

The knowledge retention findings are particularly noteworthy. The experimental group retained 93.0% of their post-test knowledge after four weeks, compared to 89.2% in the control group. While both groups demonstrated some decay, the experimental group's higher absolute scores at follow-up ($M = 31.8$ vs. 26.4) indicate that gamified microlearning produced more durable learning. This finding is consistent with the systematic review by Javed and Lal Din (2025), which reported that microlearning interventions showed long-term benefits across immediate and delayed tests (pooled SMD = 0.68). The retention advantage may be attributable to the retrieval practice embedded in the Kahoot! quizzes, which strengthens memory consolidation through repeated testing (Roediger & Karpicke, 2006), and

to the spaced repetition notifications that distributed practice over time.

5.2 Mechanisms of Effectiveness

Several mechanisms may explain the observed effects. First, the microlearning format reduces cognitive load by presenting content in manageable chunks, aligning with Cognitive Load Theory (Sweller, 1988). Second, gamification elements (points, badges, leaderboards) satisfy students' needs for competence and relatedness, fostering intrinsic motivation as predicted by Self-Determination Theory. Third, the immediate feedback provided by Kahoot! quizzes reinforces correct responses and corrects misconceptions in real time. Fourth, the competitive yet collaborative nature of gamified activities may have enhanced social relatedness and peer learning.

The finding that gamification's effects are domain-specific (Chen et al., 2026) is relevant here: the present study focused on theoretical knowledge rather than practical skills, and the large effects observed suggest that gamified microlearning is particularly well-suited for knowledge acquisition and retention. Future research should examine whether similar effects extend to psychomotor skill development.

5.3 Comparison with Existing Literature

The results of this study are consistent with the broader evidence base. The IRCT-registered trial at Qom University of Medical Sciences (2026) investigating gamification based on adaptive microlearning for ECG interpretation among 51 nursing students provides a methodological template that the present study partially replicated, though with a larger sample and a focus on general adult health nursing content rather than a specialised skill.

The quasi-experimental study by Ma et al. (2026) with 140 critical care nursing students found that a gamified intervention improved learning engagement (mean difference = 7.06) and theoretical performance. The present study's engagement effect (mean difference = 0.85 on a 7-point scale, corresponding to a substantial practical difference) is consistent with these findings.

Notably, the present study addresses a gap identified in the literature: the scarcity of research on gamified microlearning in Pakistani public-sector nursing institutions. While Hanif and Vadivala (2025) documented gamification integration at a private university in Karachi (Aga Khan University), the present study is among the first to rigorously evaluate gamified microlearning in a public-sector institution in South Punjab, thereby enhancing the generalisability of findings to similar contexts.

5.4 Practical Implications

The findings have several practical implications for nursing education at Nishtar Medical University and comparable institutions:

- Curriculum Integration:** Gamified microlearning modules should be systematically integrated into nursing curricula, particularly for knowledge-dense courses such as Adult Health Nursing, Pharmacology, and Pathophysiology.
- Faculty Development:** Nursing faculty require training in gamification design principles and microlearning content development to effectively implement these strategies.
- Technology Infrastructure:** Institutions should ensure reliable internet access and student access to smartphones or tablets to support digital gamified learning platforms.
- Assessment Redesign:** Traditional assessment methods may need to be complemented by gamified formative assessments that provide ongoing feedback and promote retrieval practice.
- Resource Considerations:** The low-cost nature of tools such as Kahoot! (freemium model) makes gamified microlearning feasible even in resource-constrained public-sector institutions.

5.5 Limitations

Several limitations should be acknowledged. First, the quasi-experimental design, while appropriate for the educational setting, introduces potential selection bias that randomization would eliminate. Second, the single-institution setting limits generalizability to other nursing colleges in Pakistan. Third, the four-week follow-up, while longer than many studies in this field, does not

capture long-term retention beyond one month. Fourth, the study focused on theoretical knowledge; practical skill acquisition and transfer were not assessed. Fifth, the use of a single gamification platform (Kahoot!) may limit applicability to other gamified microlearning tools.

6: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study demonstrates that gamified microlearning is an effective pedagogical strategy for enhancing classroom engagement and knowledge retention among undergraduate nursing students at the College of Nursing, Nishtar Medical University, Multan. The intervention produced large, statistically significant improvements in engagement across all dimensions and in knowledge retention at both immediate and four-week follow-up assessments. These findings contribute locally generated evidence to the international literature on gamified microlearning and support the integration of these strategies into Pakistani nursing curricula.

6.2 Recommendations

For Nursing Education Practice:

- Integrate gamified microlearning modules into at least 30% of theoretical course content.
- Provide faculty development programmes on gamification design and microlearning pedagogy.
- Establish a resource repository of gamified microlearning content shared across nursing programmes in South Punjab.

For Nursing Education Policy:

- The Pakistan Nursing Council should consider including gamified learning competencies in nursing educator certification requirements.
- Provincial health departments should allocate resources for educational technology infrastructure in public-sector nursing colleges.

For Future Research:

- Multi-center randomized controlled trials comparing gamified microlearning with other active learning strategies.
- Longitudinal studies tracking knowledge retention and clinical application over 6–12 months.
- Investigation of gamified microlearning for psychomotor skill development.
- Qualitative studies exploring student and faculty experiences with gamified microlearning in Pakistani nursing education.

REFERENCES

- Atasever, İ., et al. (2025) 'The effectiveness of a gamified lesson plan using the TOY gamification model in nursing education', *Computers, Informatics, Nursing*, 43(9), e01327. doi: 10.1097/CIN.0000000000001327.
- Chen, Y.-J., Chang, L.-F., et al. (2026) 'Comparative effectiveness of game-based learning modalities in nursing and medical education: a systematic review and Bayesian network meta-analysis', *Nurse Education Today*, 167, 107266. doi: 10.1016/j.nedt.2026.107266.
- Fijačko, N., Masterson Creber, R., Metličar, Š., Strnad, M., Greif, R., Štiglic, G. and Skok, P. (2024) 'Effects of a serious smartphone game on nursing students' theoretical knowledge and practical skills in adult basic life support: randomized wait list-controlled trial', *JMIR Serious Games*, 12, e48827. doi: 10.2196/48827.
- Hanif, S. and Vadivala, R. (2025) 'Integration of digital modality in virtual classroom enhancing nursing students' inclusivity in learning: a game-based approach', *Journal of the College of Physicians and Surgeons Pakistan*, 35(10), pp. 1–4.

- IRCT (2026) *Investigating the effect of gamification based on adaptive microlearning on knowledge, skills, and self-efficacy in ECG interpretation among undergraduate nursing students*. Available at: <https://irct.ir/> (Accessed: 10 October 2026).
- Javed, I. and Lal Din, A. (2025) 'Efficacy of microlearning and social media-based educational interventions on knowledge retention in nursing students: a systematic review and meta-analysis', *Pakistan Journal of Medical & Cardiological Review*, 2(2), pp. 1–12.
- Khosravi, Z., et al. (2026) 'Learning in small doses, impact in big ways: effects of mobile microlearning on patient safety competency in nursing students', *Nurse Education in Practice*, 84, 104218.
- Ma, X., Yang, F. and Yu, A. (2026) 'Educational outcomes of CDIO-guided progressive case-based learning and gamification in undergraduate critical care nursing: an exploratory two-class quasi-experimental study', *Frontiers in Public Health*, 14, 1958746. doi: 10.3389/fpubh.2026.1958746.
- Miri, S., Shamsi, A., Yarahmadi, S. and Shahidi Delshad, E. (2025) 'Comparing microlearning and flipped classroom methods to enhance arterial blood gas interpretation learning in nurse anaesthesia students using Kirkpatrick's evaluation model: a study protocol', *BMJ Open*, 15(12), e110526. doi: 10.1136/bmjopen-2025-110526.
- Nurse Education Today (2026) 'Teaching social and structural determinants of health in nursing: a comparative analysis of microlearning, problem-based learning, and gamification', *Nurse Education Today*, 156, 106373.
- Pangandaman, H.K., Datumanong, N.T., Diamla, M.R.L., Raki-in, R.M., Hayudini, M.A.A., Amil, J.H., Alih, S.-A.J., Iskandal, I.I., Abduhadi, A.-R.A. and Tan, A.R.A. (2025) 'Gamification in nursing education: a systematic review of its impact on knowledge retention and skills development among novice nursing students', *Cuestiones de Fisioterapia*, 54(5), p. 275.
- Sarfraz, S., Suhag, A.K. and Jawed, T. (2025) 'Assessing the effectiveness of gamified activity on motivation and engagement, understanding, and assessment outcomes in undergraduate nursing students in Karachi', *The Critical Review of Social Sciences Studies*, 3(4), pp. 1701–1714.
- Wang, Y.-F., Hsu, M.-H., Wang, M.Y.-F. and Xiao, H.-L. (2026) 'MEDILEGACY: a gamified platform for enhancing medical terminology learning through engagement and retention', *Health Education Journal*, 85(2), p. 150. doi: 10.1177/00178969251389388.
- ALIAS, N. F. & ABDUL RAZAK, R. 2023. Exploring the pedagogical aspects of microlearning in educational settings: A systematic literature review. *Malaysian Journal of Learning and Instruction (MJLI)*, 20, 267-294.
- ALIAS, N. F. & RAZAK, R. A. 2025. Revolutionizing learning in the digital age: A systematic literature review of microlearning strategies. *Interactive Learning Environments*, 33, 1-21.
- DENOJEAN-MAIRET, M., LÓPEZ-PERNAS, S., AGBO, F. J. & TEDRE, M. 2024. A literature review on the integration of microlearning and social media. *Smart Learning Environments*, 11, 46.
- MONIB, W. K., QAZI, A. & APONG, R. A. 2025. Microlearning beyond boundaries: A systematic review and a novel framework for improving learning outcomes. *Heliyon*, 11.