Digital Gamified Learning in Teacher Education: Insights from Pre-service Teachers in Kasaragod District

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Abstract

This study employs a descriptive survey methodology to assess the awareness, experiences, and perceptions of the B.Ed. trainees regarding digital gamified learning (DGL) within the Kasaragod district of Kerala state. The research aims to elucidate pre-service teachers' familiarity with DGL, first-hand experiences, interest levels, and preferred devices for such learning modalities. Results reveal a spectrum of familiarity levels among participants and a high interest in DGL, albeit with inconsistent practical engagement. The findings indicate that smartphones and laptops are most favoured for accessing DGL. Collectively, the respondents exhibited a positive outlook towards DGL, highlighting its prospective utility in future educational contexts. However, the study emphasises the necessity for enhanced training and exposure to fully harness the benefits of DGL in educational frameworks.

Keywords: *Digital Gamified Learning, Pre-service Teacher Perceptions, Kasaragod District, Awareness, Experiences, Perception, Teacher Education.*

Introduction

Traditional teaching and learning methods typically involve direct knowledge transmission in a classroom setting. As information technology has evolved, web-based learning has become a viable alternative. Educational games are particularly effective in this digital landscape, part of the broader multimedia learning environment. These interactive tools can significantly enhance engagement and effectiveness among younger students. Acknowledging this potential, researchers and game developers have suggested various models to improve the digital learning environment. However, many of these models fail to address the specific learning behaviours crucial for supporting the educational process in game-based learning environments (Tan et al., 2007). Digital gamified learning hinges on two core ideas: first, modern learners have fundamentally evolved with digital technology; second, computer games can motivate today's students effectively (Prensky, 2005). Gamification has emerged as a valuable strategy in education, effectively motivating learners, fostering interaction, and promoting positive social outcomes. E-learning systems often leverage gamified elements such as points, badges, feedback, level progression, rewards, challenges, and other techniques to create more engaging and effective learning environments (Saleem et al., 2022). While numerous studies have explored gamification in education (Smiderle et al., 2020), its effectiveness remains a subject of debate. Despite integrating gamification into classrooms to enhance learning outcomes at various levels, there is still a lack of consensus on its true potential. This discrepancy may arise from the term 'gamification' itself, often associated with games, entertainment, and fun, which are not

traditionally linked to learning. Conversely, it is inaccurate to view gamification as a universal solution for both learners and educators (Papp, 2017).

Gamified learning is a teaching method that uses games to deliver educational content engagingly and enjoyably, drawing on motivational psychology. This approach involves designing interactive activities that help students progressively grasp concepts and achieve specific learning goals (Boche, 2019). This approach lets students use different game elements to improve skills and meet learning objectives. Prensky's 2001 view that educational software should use game design techniques is now widely recognised in educational technology research. Digital gamified learning (DGL) is a promising educational method that utilises video games to improve learning outcomes. It is particularly effective for today's digitally-savvy youth, enhancing visual literacy and interaction (Chaudhary, 2008). While some educators remain sceptical, DGL's potential for improving student engagement and knowledge retention is gaining recognition (Pivec, M., 2007). Various game platforms, such as Minecraft: Education Edition, Code.org and Tux Racer, demonstrate how video games can be integrated into classroom settings to create enjoyable learning experiences (Triantafyllou, A, 2022). A typology of four Digital Gamified Learning genres is proposed to help teachers understand the pedagogical process and challenges in implementing Digital Gamified Learning (Wu, 2018). Digital Gamified Learning can positively impact student engagement and achievement when designed with key game and instructional elements (Serrano, 2019). A game-based learning environment can incorporate elements such as scaffolding, problem-driven activities, exploration, context, agency, interaction, learning through doing, learning through failure, moments for reflection, character involvement, and overall engagement (An & Bonk, 2009).

Review of Related Literature

Compiling past research on the impact of gamified learning indicates that subjects such as social science, mathematics, and computer science are enhanced through game-based learning. Additionally, digital gamified learning contributes to cognitive, emotional, and social enhancements in the learning process.

Gamified learning can enhance 21st-century skills by integrating practical design elements and educational theories (Meihua Qian & Karen R. Clark, 2016). Combining cognitive, motivational, affective, and sociocultural frameworks in game design and research maximises their academic potential (Plass, J. et al., 2015). Student-centred digital gamified learning primarily focuses on single-player experiences and active learning but needs further study on multiplayer engagements and social aspects like mutual respect (Thomas E. Coleman & Arthur G. Money, 2019). Gamifed learning in programming courses enhances the student experience, knowledge gain, and usability, with varying benefits based on location, educational background and the games played (Dan Zhao et al., 2022). Game design features in gamifed learning promote engagement and learning at both cognitive and emotional levels, with external factors also influencing these outcomes (Azita Iliya Abdul Jabbar & P. Felicia, 2015). Gamifed learning can enhance education by engaging learners and addressing mental, emotional and social aspects, but it must complement traditional approaches and address interdisciplinary competencies (Simon Greipl et al., 2020). Classcraft, a gamification platform, has the potential to optimize learning experiences (Thiyagu, 2021). By incorporating gamified rewards, interactive environments, and collaborative activities, Classcraft can fulfil the criteria for optimal gamified learning. This platform effectively facilitates optimal gamification learning processes, which can positively impact both learning outcomes and motivation (Zhang et al., 2021).

Game-based science learning promotes scientific knowledge and concept learning to enhance its potential for effective science education (Ming-Chaun Li & Chin-Chung Tsai, 2013). Digital gamified learning shows promising potential in elementary science education, particularly in content understanding, but more research is needed to confirm its effectiveness in other areas (Mahmood H. Hussein et al., 2019). Gamified learning environments can engage students in science learning and enhance motivation, resulting in fun while learning (Min Liu et al., 2014). The learning environment was enhanced through gamification, incorporating elements like point-based competitions, leaderboards, and Python programmer badges. This gamification strategy led to a notable improvement in learners' academic performance. Additionally, it stimulated self-directed learning, with a significant difference observed before and after its implementation (Palaniappan & Noor, 2022).

Gamify pedagogy in mathematics education shows positive gains in knowledge, cognitive skills, affection and behavioural change, with traditional teaching being the most popular comparison approach (Mahmood H. Hussein et al., 2021). Game-based learning-building services in engineering education can increase student engagement and make learning more meaningful. Still, more comprehensive approaches using advanced information tools are needed for future development (Kari Alanne, 2016). Using severe games and digital mini-games, gamified earning significantly increases learners' logical-mathematical reasoning and linguistic capabilities (Pérez, M. et al., 2018). Using teacher-authored games in computer science education, gamifed learning is as effective as traditional teaching in knowledge acquisition but significantly increases learner motivation and enjoyment (López-fernández. D et al., 2021). However, selecting the appropriate combination of game elements continues to be a challenge for gamification designers and practitioners. This is due to the absence of established design methodologies and the lack of a universal approach that can be applied to all gamification contexts (Khaldi et al., 2023).

Digital gamified learning, when effectively used in delivering the instruction, helps improve student engagement and interest in game design elements, enhancing learning outcomes (Qing Li et al., 2014). Digital gamified learning has become a mainstream educational tool due to ongoing research, the rise of the 'net generation' and the desire for interactive, engaging learning experiences (Richard N. Van Eck, 2006). Digital gamified learning offers undiscovered potential for universities and lifelong learning, transforming games from unserious activities into a new form of interactive content worth exploring (Pivec, M, 2007). Game design models can enhance the impact of educational computer games by providing immediate feedback, clear goals, and challenges matched to skill levels (Kiili, K, 2005). The value embedded in gamified learning plays a crucial role in shaping perceptions. However, the significant impacts of factors such as reasons for and against sustainable purchasing and sustainable purchasing attitudes, including the moderating effect of perceived sustainable expertise, vary between different groups (Zafar et al., 2024).

Objectives

Based on the study, the following objectives were formulated to:

1. Assess the level of awareness about digital gamified learning (DGL) among the respondents.
2. Investigate the extent of prior experience with DGL among the respondents.
3. Determine the frequency and depth of hands-on experience with DGL among the respondents.
4. Evaluate the interest level among respondents in learning subjects through DGL.
5. Identify the devices preferred by respondents for engaging with DGL.

6. Gauge the overall perception towards DGL among the respondents.
7. Measure the respondents' specific perceptions towards DGL concerning each evaluative statement.
8. Find out whether there exists any significant difference in the mean scores of pre- service teachers' attitude towards the digital gamified learning with respect to their gender, locality and subject stream.

Hypotheses

The following hypotheses were formulated based on the study:

1. There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their gender.
2. There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their locality.
3. There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their subject stream.

Method

The researcher aims to explore the attitudes toward digital gamified learning among pre-service teachers in the Kasaragod district. A normative survey method was employed to gather data on these attitudes. Normative surveys, often called descriptive research, describe and interpret existing conditions or attitudes. This method utilises statistical norms and standards deemed typical for the specific group under study to ensure relevant and accurate data collection (John, W. Best et al., 2017). This sample represents a manageable and representative subset of the larger population, facilitating detailed research and analysis (Will, Curtis et al., 2013). In this context, the term 'normative' indicates an effort to ascertain what is considered normal or standard among a specific group. In this case, the researcher collected data to understand student teachers' attitudes toward gamified learning in the Kasaragod district.

Population and Sample

The objective of the survey research is to outline the characteristics of a broader population. This goal is typically achieved by collecting data from a representative sample derived from that population. The initial phase of the sampling process involves defining the population in question. For this study, the population consists of all pre-service teachers currently enrolled in educational programmes within the Kasaragod district. Specifically, these include individuals engaged in courses like Diploma in Elementary Education (D.El. Ed) after 10+2 and B.Ed. after graduation. A total of 306 pre-service teachers from the Kasaragod district were chosen to constitute the sample. These participants collectively represent a variety of independent variables, including gender, subject specialisation, locality, age, and type of residence.

Tools

In this study, the researcher developed a 5-point attitude rating scale to gauge respondents' levels of agreement or disagreement with a series of statements. Each item on the scale offered five response options, ranging from 'strongly agree' to 'strongly disagree,' with values assigned from 1 to 5 (Thiyagu, 2021). Given that the research utilised a survey method, the researcher crafted a tool comprising a questionnaire to gather basic information and opinions about digital gamified learning features. This tool aimed to elicit specific responses from pre-service teachers, helping to assess their attitudes towards digital gamified learning in the Kasaragod district. The format of the questions and statements was carefully designed to capture pre-service teachers' attitudes accurately. The development of the tool involved an extensive review of related

literature and previous studies on similar topics. The researcher collaborated with her advisor to finalise the instrument, ensuring it included clear and appropriate instructions to guide participants towards providing accurate responses.

Findings and Interpretation

The following are the findings and interpretations of the result.

Objective 1: Assess the level of awareness about digital gamified learning (DGL) among the respondents.

Table 1: Analysis of the sample based on awareness of DGL

Awareness on DGL	No. of Pre-service Teachers	Percentage (%)
Yes	114	37.3
No	192	62.7

The sample analysis reveals significant insights into digital gamified learning (DGL) awareness levels among pre-service teachers in Kasaragod district. The findings are as follows: The data indicates that 37.3% of pre-service teachers know DGL. This subset of students has some level of familiarity with the concept and its application in educational contexts. Conversely, 62.7% of pre-service teachers are unaware of DGL. This indicates a significant gap in knowledge and familiarity with this modern pedagogical approach among most pre-service teachers. The findings suggest that most pre-service teachers in Kasaragod district need more awareness of DGL, with nearly two-thirds of the sample indicating unfamiliarity with this educational tool. This highlights the need for increased exposure and training in DGL for pre-service teachers to enhance their understanding and potential integration of digital gamified learning strategies in their future teaching practices. Efforts to bridge this knowledge gap involve incorporating DGL concepts into teacher education curricula and providing practical training sessions to demonstrate the benefits and applications of DGL in the classroom.

Objective 2: Investigate the extent of prior experience with DGL among the respondents.

Table 2: Analysis of sample based on their previous experience in DGL

Experience on DGL	No. of Pre-service Teachers	Percentage (%)
Yes	61	19.9
No	245	80.1

The sample analysis based on pre-service teachers' attitudes towards digital gamified learning (DGL) revealed the following: Among the 306 students surveyed, 19.9% reported having experience with DGL. Conversely, 80.1% of the students indicated that they did not have any prior experience with DGL. The data suggests that most pre-service teachers (80.1%) lack prior experience with digital gamified learning. This finding indicates that almost all pre-service teachers in the sample are relatively new to DGL. Consequently, there may be a need for targeted training and professional development initiatives to familiarise these future educators with the concepts and practical applications of DGL, thereby enhancing their competence and confidence in integrating such innovative approaches into their teaching practices.

Objective 3: Determine the respondents' frequency and depth of hands-on experience with DGL.

Table 3: Analysis of sample based on previous experiences with DGL

Attempts in DGL	No. of Pre-service Teachers	Percentage (%)
1 time	51	47.7
2-5 times	37	34.6
5-10 times	10	9.3
More than 10 times	9	8.4

For the purpose of this objective, the frequency and depth of respondents' hands-on

experience with DGL were examined. Among the total of 306 respondents, only 107 indicated that they had practical experience with DGL. Consequently, the analysis was restricted to these 107 respondents, as they were deemed to possess the requisite expertise for meaningful evaluation.

The sample analysis based on the number of attempts in digital gamified learning (DGL) made by pre-service teachers revealed the following facts. The data indicates that nearly half (47.7%) of the pre-service teachers have engaged with DGL only once. Additionally, a significant portion (34.6%) have made 2 to 5 attempts. A smaller percentage of students (9.3%) engaged in DGL between 5 and 10 times, while an even smaller fraction (8.4%) participated more than ten times. These findings suggest that most of the students have had limited exposure to DGL, with the majority not progressing beyond a few attempts. This trend underscores the need for more opportunities and encouragement for pre-service teachers to engage consistently with DGL, which could enhance their familiarity and proficiency with this learning approach.

Objective 4: Evaluate the interest level among respondents in learning subjects through DGL.

Table 4: Analysis of sample based on interest to learn subjects through DGL

Interest on DGL	No. of Pre-service Teachers	Percentage (%)
Yes	230	75.2
No	76	24.8

The sample analysis based on pre-service teachers' attitudes towards digital gamified learning (DGL) revealed the following: The data shows that a substantial majority (75.2%) of pre-service teachers are enthusiastic about engaging in digital gamified learning courses. This high interest suggests a positive attitude towards integrating innovative and interactive learning methods such as DGL into their educational practices. However, a notable minority (24.8%) of pre-service teachers are not interested in DGL courses. This may point to a need to address potential barriers, such as lack of familiarity with DGL, perceived relevance, or technological apprehensions. Tailored strategies to enhance awareness and demonstrate the benefits of DGL could help increase overall acceptance and participation among pre-service teachers.

Objective 5: Identify the devices preferred by respondents for engaging with DGL.

Table 5: Analysis of the sample in terms of the preferred device used for DGL

Preferred Device	No. of Pre-service Teachers	Percentage (%)
Tab	30	9.8
Laptop	159	52
Mobile phone	199	65

The sample analysis based on pre-service teachers' preference of devices for digital gamified learning revealed the following: The data indicates that most pre-service teachers (65%) prefer using mobile phones to participate in digital gamified learning. This preference suggests a high level of comfort and accessibility associated with mobile phones, making them a popular choice for engaging with DGL. Laptops are also a preferred device for a significant portion of the sample (52%), indicating their suitability for DGL activities. However, only a tiny percentage (9.8%) of students favoured tablets, which might reflect lesser usage or familiarity with this device type for educational purposes. These findings highlight the importance of optimising DGL content for mobile phones and laptops to cater to the majority preferences of pre-service teachers.

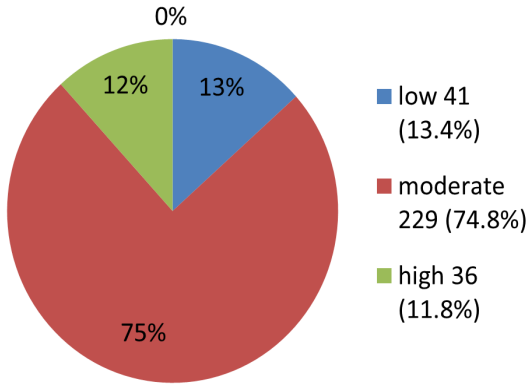
Objective 6: Gauge the overall perception towards DGL among the respondents.

Table 6: Analysis of the sample in terms of their level of attitude towards DGL

Attitude towards DGL	Pre-service Teachers	Percentage (%)
Low	41	13.4
Moderate	229	74.8
High	36	11.8

The sample analysis based on the level of attitude towards DGL revealed the following: The data indicates that most pre-service teachers (74.8%) have a moderate attitude towards digital gamified learning. This suggests a general acceptance and openness to DGL among most students, though not necessarily a strong enthusiasm. A smaller segment of the sample (13.4%) exhibits a low attitude towards DGL, indicating some resistance or lack of interest in this learning approach. Meanwhile, 11.8% of the students have a high attitude towards DGL, demonstrating strong interest and positive perception. These findings highlight the need for strategies to enhance the attitude demonstration of the benefits of DGL to foster a more favourable outlook across the board.

The following graph shows the level of attitude of pre-service teachers towards digital gamified learning (DGL)



Level of attitude of pre-service teachers towards DGL

Objective 7: Measure the respondents' perceptions of DGL concerning each evaluative statement.

Table 7: Analysis of the sample in terms of their perception of DGL

No.	Statements	SD F (%)	DA F (%)	N F (%)	A F (%)	SA F (%)
1	I feel more convenient if the subject is taught through digital games.	11 (3.6%)	32 (105%)	127 (41.5%)	110 (35.9%)	26 (8.5%)
2	Digital gamified learning is not suitable for all subject streams.	13 (4.3%)	79 (25.8%)	109 (35.6%)	90 (29.4%)	15 (4.9%)
3	Games-based learning utilizes gaming technologies to establish an engaging, motivating, and interactive virtual learning environment	23 (7.5%)	15 (4.9%)	70 (23.9%)	152 (49.7%)	46 (15%)
4	Evaluation is not easier and more accurate when using DGL	32 (10.5%)	121 (39.5%)	102 (33.3%)	29 (9.5%)	22 (7.2%)
5	Login with username and password provide digital safety and privacy in DGL	14 (4.6%)	31 (10.1%)	91 (297%)	125 (408%)	45 (14.7%)

6	The provision of rechecking and correction of answers make me comfortable while using DGL platforms	16 (5.2%)	17 (5.6%)	127 (43.5%)	122 (39.9%)	24 (7.8%)
7	DGL helps me to get and view my results quickly	15 (4.9%)	26 (8.5%)	77 (25.2%)	144 (47.1%)	44 (14.4%)
8	Learning through digital game platforms are clearer and easier to understand the content.	17 (5.6%)	15 (49%)	97 (31.7%)	141 (46.1%)	36 (11.8%)
9	Digital gamified learning can engage and motivate students, offering personalized experiences that enhance long-term memory and practical skills.	17 (5.6%)	16 (5.2%)	113 (36.9%)	125 (40.8%)	35 (11.4%)
10	System feedback through DGL platform helps me to reflect and knowing my achievement in learning progress.	10 (3.3%)	25 (8.2%)	118 (8.6%)	125 (40.8%)	28 (9.2%)
11	I believe that DGL is more systematic in execution and conduction.	13 (4.2%)	30 (9.8%)	129 (42.2%)	106 (34.6%)	28 (9.2%)
12	I feel using DGL allows learners to focus and concentrate more on the subjects.	12 (3.9%)	35 (11.4%)	30 (42.5%)	107 (35%)	22 (7.2%)
13	Always interested in learning through DGL because I can be able to retrieve the previous learning resources from the digital game platform.	15 (4.9%)	29 (9.5%)	132 (43.1%)	102 (33.3%)	28 (9.2%)
14	Through DGL I can improve my technical competency while using the technological devices and tools.	13 (4.2%)	27 (8.8%)	90 (29.4%)	116 (37.9%)	60 (19.6%)
15	I feel DGL is highly individualized in terms of time and pace.	17 (5.6%)	24 (7.8%)	121 (39.5%)	118 (38.6%)	26 (8.5%)

Results from the survey provide an overall picture of how pre-service teachers view digital gamified learning on various dimensions, such as convenience, engagement, technical adequacy, feedback, and individualisation. In general, the results show a largely positive response towards DGL, yet a large number of respondents were neutral across a number of statements, showing areas where extended exposure and familiarity are required.

Convenience and Appropriateness of DGL: Pre-service teachers indicated moderate agreement on the convenience of DGL. Although 44.4% agreed or strongly agreed that DGL is convenient, a significant 41.5% were neutral. This indicates that although most appreciate the utility of digital gamification in learning, many are still unsure, perhaps because of lack of exposure. Likewise, for the suitability of DGL across subject streams, the feedback was mixed. A total of 30% agreed with the idea, but 30.1% disagreed and 35.6% did not have a view. Such a split suggests that although there are those who

think that DGL can be applied across fields, there are others who are doubtful about its applicability in all fields.

Engagement and Interactivity: One of the most emphatic areas of consensus was regarding engagement and interactivity. An impressive 64.7% of the respondents agreed or strongly agreed that game-based learning makes learning engaging and interactive. This suggests broad acceptance of DGL's ability to enhance learning and make it more engaging and fun. The idea that DGL increases engagement, motivation, and offers personalized experiences was also moderately accepted, with 44.4% in agreement, even though 41.5% were neutral. The positive agreement indicates that most teachers recognize the potential of DGL to increase deeper learning, though a lack of strong agreement suggests that the idea might still be intangible for some.

Assessment and Feedback: Pre-service teachers tended to have a positive perception of DGL regarding assessment and feedback. Fifty per cent of the respondents disagreed with the statement that it is not easy to evaluate using DGL, which suggests they believe it is effective for assessment. Furthermore, 50% agreed that system feedback using DGL facilitates reflection on learning progress. These findings align with the idea that DGL improves the process of evaluation by providing instant and explicit feedback. The high agreement rate here highlights DGL's function in encouraging formative evaluation and self-awareness.

Technical Features and Security: There was a clear appreciation of the technical features of DGL by the respondents. A high 55.5% accepted that employing a login system offers sufficiency, implying that they think that DGL platforms are secure and usable. In addition, 57.5% felt that DGL contributes to increasing their technical knowledge, pointing to a vital ancillary advantage of gamified learning – building digital literacy. The capacity for access to stored learning materials was also appealing to 42.5% of pre-service teachers, although 43.1% were undecided, which might indicate either ignorance of this capability or lack of utilization in available platforms.

Transparency and Comprehensibility: Regarding transparency and understanding, 57.9% agreed that DGL makes content easier to understand, pointing to its effectiveness in clarifying complex concepts through visual and interactive formats. This positive perception supports the integration of gamification to aid content comprehension, especially for visual or experiential learners. Personalization and flexibility were supported moderately. Approximately 47.1% concurred that DGL is extremely personalized regarding time and tempo, and 42.2% believed that it enhances focus and concentration. Neutral answers, however, continued to be high (approximately 40%) for both, which indicates that the potential of DGL is indeed acknowledged but not necessarily the extent to which this can be delivered in personalized form in their respective learning contexts. On being questioned regarding DGL's systematic implementation, 43.8% concurred that it is more structured, but 42.2% were neutral. This again reflects uncertainty or lack of first-hand experience. Users who have utilized DGL to a greater extent might identify its structured nature, whereas others might require guided exposure to value its systematic nature.

In conclusion, the information indicates a generally positive attitude towards DGL among pre-service teachers, especially in terms of engagement, interactivity, feedback, technical proficiency, and understanding of content. The high level of agreement in these categories indicates that most respondents view DGL as a valuable and contemporary learning tool. Yet, the repeatedly high number of neutral responses to numerous statements reflects a high degree of uncertainty or lack of experience with DGL. Neutrality points to an openness to the idea, but pre-service teachers need more experience, training, and evidence-based interventions in order to be more confident in DGL's effectiveness in all areas. The results also point out that

DGL is received positively in areas such as motivation, assessment, and accessibility, but its applicability to all subjects and deeper customization aspects are areas that require further investigation and proof. Bridging these gaps with teacher training programmes, workshops, and exposure to effective DGL implementations may help turn neutral and negative attitudes into a more universally positive one. Finally, the data introduces DGL as a viable teaching method with high perceived advantages, balanced by zones of doubt that can be overcome through professional development and pragmatic incorporation into pedagogical practice.

Hypotheses Testing

H_o1 There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their gender.

Table 8: Difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their gender.

Gender	N	Mean	SD	Df	't' Value	'p' Value	Remarks at 5% level
Male	126	124.34	14.09	304	8.01	0.00	**Significant**
Female	180	110.66	15.13				

The above table shows that the computed 't' value is 8.01. Since $p < 0.05$, that is lesser than the significance level $\alpha = 0.05$, then the null hypothesis is rejected, and it can be said that there is significant difference in the mean scores of pre-service teachers' attitude towards digital gamified learning with respect to their gender. Thus, pre-service teachers' attitude towards the digital gamified learning is affected due to their gender. Male pre-service teachers are better than the female pre-service teachers in their attitude towards DGL.

H_o 2 There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their locality.

Table 9: Difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their locality.

Locality	N	Mean	SD	Df	't' Value	'p' Value	Remarks at 5% level
Rural	130	112.2	12.12	304	7.52	0.00	**Significant**
Urban	176	122.3	11.14				

The above table shows that the computed 't' value is 7.52. Since $p < 0.05$, that is lesser than the significance level $\alpha = 0.05$, then the null hypothesis is rejected, and it can be said that there is significant difference in the mean scores of pre-service teachers' attitude towards digital gamified learning with respect to their locality. Thus, pre-service teachers' attitude towards the digital gamified learning is affected due to their locality. Urban pre-service teachers are better than the rural pre-service teachers in their attitude towards DGL.

H_o 3: There is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their subject stream.

Table 10: Difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to their subject stream.

Subject Stream	N	Mean	SD	Source of Variation	Sum of squares	Df	Mean square	'F' Value	'p' value
Arts	98	119.8	15.7	Between Groups	66.45	2	33.22	0.131	0.877
Science	166	120.8	16.0	Within Groups	76827.20	303	253.55		
Language	42	120.8	13.3	Total	76893.65	**Not significant at 0.05 level**			

It is clear from Table 10 that the mean scores of pre-service teachers' attitude towards the digital gamified learning in the case of arts stream is 119.8 and corresponding standard deviation is 15.7. Moreover, the mean scores of attitude towards the digital gamified learning of science pre-service teachers and language pre-service teachers are 120.8 and 120.8, respectively, and their corresponding standard deviations are 16.0 and 13.3, respectively. However, the calculated value of F is not significant at any level ($F = 0.131$; $p > 0.05$). Therefore, the null hypothesis is not rejected. Hence there is no significant difference in the mean scores of pre-service teachers' attitude towards the digital gamified learning with respect to the subject stream. Thus, pre-service teachers' attitude towards the digital gamified learning is not affected due to the subject stream.

The study found significant differences in the attitudes of pre-service teachers towards digital gamified learning (DGL) based on gender and locality. Male pre-service teachers showed more positive attitudes than females, and urban pre-service teachers scored higher than rural ones. These differences were statistically significant, leading to the rejection of the null hypotheses in both cases. However, no significant difference was observed based on the subject stream (arts, science, or language), as the F-value was not significant ($p > 0.05$). Therefore, while gender and locality influence attitudes of pre-service teachers towards DGL, subject stream does not appear to have an impact on these attitudes.

Discussion of the Study

The study examined the awareness, experience, and perceptions of digital gamified learning (DGL) among 306 pre-service teachers, offering essential insights into its current state in teacher education and identifying areas for improvement and future research.

Awareness and Experience with DGL: A significant gap in awareness and experience with DGL was found among the pre-service teachers. Only 37.3% were aware of DGL, and just 19.9% had any prior knowledge. This suggests that DGL has yet to be widely recognised or used in teacher education programmes. The lack of exposure may limit future educators' ability to adopt innovative teaching methods in their classrooms.

Limited Engagement with DGL: Most pre-service teachers needed more hands-on experience with DGL. Nearly half (47.7%) had only used DGL once, and 34.6% had used it two to five times. This limited engagement implies that pre-service teachers need more opportunities to explore and utilise DGL in their learning. More hands-on practice opportunities are required to build confidence and competence in this approach.

Interest in DGL: Despite the limited awareness and experience, there is strong interest in DGL among pre-service teachers. Most of them (75.2%) showed enthusiasm for participating in DGL courses. This positive attitude suggests a readiness to adopt innovative and interactive learning methods. However, the 24.8% who are not interested indicate that barriers such as

lack of familiarity, perceived relevance, or technological apprehensions must be addressed.

Device Preferences for DGL: Mobile phones (65%) and laptops (52%) were the preferred devices for engaging with DGL, emphasising the need to optimise DGL content for these platforms. Tablets were less favoured (9.8%), possibly due to lower usage or familiarity for educational purposes. Making DGL content accessible and user-friendly on mobile phones and laptops will cater to the majority's preferences.

Overall Attitude Towards DGL: Most pre-service teachers (74.8%) had a moderate attitude towards DGL, indicating general acceptance and openness. However, only 11.8% had a highly positive attitude, showing limited strong enthusiasm for DGL. Enhancing attitudes towards DGL could involve increased exposure, training, and showcasing its benefits.

Perceptions of DGL's Benefits: Pre-service teachers recognized several benefits of DGL, including its potential to engage and motivate students, facilitate efficient evaluation, and enhance technical competency. The positive perceptions of DGL's impact on learning engagement, focus, and content understanding indicate that many students value integrating gaming technologies into educational practices.

Educational Implication of the Study

The following are the educational implications of the study.

Enhanced Training and Exposure: Integrating DGL concepts into teacher education curricula and offering practical training to close the knowledge gap is critical. This approach will improve pre-service teachers' understanding and ability to apply DGL strategies in future educational practices.

Device Optimization: Since there is a preference for using mobile phones and laptops, it is important to ensure that DGL content is specifically tailored for these devices. This adjustment will enable most pre-service teachers to engage more comfortably and effectively with DGL activities.

Promotion of Benefits and Overcoming Barriers: Overcoming obstacles like unfamiliarity, perceived irrelevance, or technological hesitations is essential. By showcasing the advantages and practical uses of DGL, educators can foster greater acceptance and involvement among pre-service teachers.

Enhancement of Evaluation Processes: Leveraging DGL to streamline and enhance evaluation methods can capitalise on the system's capacity to offer immediate feedback. This improvement can aid in maintaining and boosting the efficiency of result-sharing within educational environments.

Conclusion

This study evaluated pre-service teachers' attitudes towards digital gamified learning uncovering a generally favourable outlook. Many participants recognised its potential to improve learning experiences, engagement, and evaluation methods. However, the notable uncertainty among the teachers highlights a need for more training, exposure, and proof of DGL's effectiveness. Addressing these gaps can enable educational institutions to better equip future teachers with the skills to effectively incorporate innovative digital learning strategies, thereby enhancing educational outcomes.

The research aimed to assess the receptiveness of pre-service teachers towards DGL, which has the potential to revolutionise education for educators and learners alike. Navigating the changes that come with DGL is essential for students and teachers. In the competitive educational landscape, institutions continuously seek innovative and effective teaching and learning techniques that present opportunities and challenges. Teacher education programmes must develop strategic plans to leverage DGL benefits and tackle its challenges fully. The success of DGL integration depends

on the student's willingness to adopt new educational methods and robust support from their institutions. This involves fostering an environment conducive to game-based learning, simplifying administrative tasks, securing financial backing, improving infrastructure, and enhancing the capabilities of the academic staff. Providing educators with technical and pedagogical support is crucial for seamlessly incorporating DGL into the educational framework.

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