



Effects of gamified distance learning on competence need satisfaction among undergraduate physical education students

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Abstract

This study examined the effects of gamified distance learning on the satisfaction of psychological needs for competence among undergraduate physical education students. Grounded in self-determination theory, the research aimed to determine whether integrating game-based elements into an online course could enhance students' perceived competence in a remote learning environment, which is often associated with reduced motivation and engagement. A quasi-experimental design was employed involving 120 undergraduate physical education students enrolled in a compulsory distance learning course. Participants were divided into a gamified learning group and a non-gamified control group. The gamified course incorporated elements such as points, levels, progress badges, leaderboards, and performance feedback aligned with course objectives, while the control group followed a conventional online instructional format. Data were collected over a 12-week semester using a validated competence need satisfaction questionnaire administered before and after the intervention.

The results revealed a statistically significant improvement in competence need satisfaction among students in the gamified group compared to the control group. Mean competence scores increased notably in the gamified condition, indicating that students perceived greater mastery, effectiveness, and skill development throughout the course. In contrast, the control group showed only marginal changes over time. Additional analysis suggested that structured feedback and progressive task challenges were key contributors to the observed improvements. Students in the gamified group also demonstrated higher task completion rates and reported greater confidence in applying theoretical knowledge to practical physical education contexts.

The findings suggest that gamified distance learning environments can effectively support the psychological need for competence among undergraduate physical education students. Incorporating well-designed gamification strategies may mitigate some motivational challenges associated with remote instruction and promote more meaningful learning experiences. The study concludes that educators and curriculum designers should consider gamification as a pedagogically sound approach to enhance perceived competence and learning outcomes in online physical education courses.

Keywords: Gamification, distance learning, competence need satisfaction, physical education, undergraduate students, Self-Determination Theory

Introduction

The rapid expansion of distance learning in higher education has transformed instructional practices across academic disciplines, including physical education. While online education offers flexibility and broader access, it presents unique challenges for courses traditionally grounded in physical engagement, skill development, and immediate feedback. Undergraduate physical education programs are particularly affected, as students' learning experiences are closely linked to their perceptions of skill mastery, physical competence, and instructional support. In distance learning contexts, reduced face-to-face interaction and limited opportunities for direct performance feedback may negatively influence students' motivation and psychological need satisfaction, especially the need for competence. Addressing these challenges has become a priority for educators seeking effective pedagogical strategies in remote physical education instruction.

Competence is a core psychological need described in self-determination theory, referring to an individual's desire to feel effective, capable, and successful in interacting with their learning environment. Satisfaction of this need has been consistently associated with higher intrinsic motivation, persistence, engagement, and academic performance. In physical education settings, perceived competence is a key determinant of students' participation, skill acquisition, and long-term commitment to physical

activity. However, previous studies have shown that distance learning environments may undermine competence satisfaction due to limited real-time feedback, reduced peer interaction, and the absence of structured performance cues. Consequently, innovative instructional approaches are required to support competence development in online physical education courses.

Gamification, defined as the use of game design elements in non-game contexts, has gained increasing attention as a motivational strategy in education. Common gamification components include points, levels, badges, challenges, progress tracking, and leaderboards, all of which aim to enhance learner engagement and provide clear indicators of progress. Research in higher education has demonstrated that gamification can improve student motivation, participation, and learning outcomes, particularly in online environments. In physical education and sport-related disciplines, gamified learning has been linked to increased enjoyment, adherence to training tasks, and positive learning attitudes. These outcomes suggest that gamification may be particularly effective in addressing motivational deficits associated with distance learning.

Despite growing interest in gamified instruction, existing literature reveals several limitations. Many studies focus primarily on behavioral outcomes such as participation rates or academic achievement, with less attention given to underlying psychological mechanisms. Additionally,

research specifically examining psychological need satisfaction in gamified distance learning contexts remains limited, particularly within undergraduate physical education programs. Few studies have isolated the effect of gamification on the competence need, despite its central role in physical skill development and learning motivation. This gap highlights the need for empirical research that examines how gamified distance learning environments influence students' perceptions of competence.

The present study aims to investigate the effects of gamified distance learning on competence need satisfaction among undergraduate physical education students. The primary research objective is to determine whether integrating gamification elements into an online physical education course leads to higher levels of perceived competence compared to a traditional non-gamified distance learning approach. It is hypothesized that students exposed to gamified instruction will report significantly greater competence satisfaction at the end of the course. By focusing on psychological outcomes rather than solely performance metrics, this study seeks to contribute to a deeper understanding of how gamification supports motivational processes in remote physical education settings.

This paper is structured as follows. Following the introduction, the methodology section describes the research design, participants, instruments, and procedures used in the study. The results section presents the findings related to competence need satisfaction and associated learning indicators. The discussion section interprets the results in relation to existing literature and theoretical frameworks, highlighting practical implications for physical education pedagogy. Finally, the conclusion summarizes the key findings, acknowledges study limitations, and offers recommendations for future research.

Methods

Research Design

This study adopted a quantitative, quasi-experimental research design with a pretest–posttest control group approach to examine the effects of gamified distance learning on competence need satisfaction among undergraduate physical education students. This design was selected to allow comparison between students exposed to a gamified instructional intervention and those receiving conventional online instruction, while accounting for baseline differences in perceived competence. The independent variable was the type of instructional approach used in the distance learning course (gamified versus non-gamified), and the dependent variable was students' competence need satisfaction.

Participants and Sampling

The target population comprised undergraduate students enrolled in a Bachelor's degree program in Physical Education at a public university. A total of 120 students participated in the study, drawn from two intact course sections offered during the same academic semester. Convenience sampling was employed due to institutional scheduling constraints, but efforts were made to ensure comparability between groups. One course section ($n = 60$) was assigned to the gamified learning condition, while the other section ($n = 60$) served as the control group.

Participants ranged in age from 18 to 23 years, with a balanced representation of male and female students. All

participants had prior experience with online learning platforms but had not previously completed a fully gamified academic course. Students with incomplete attendance records or those who did not complete both pretest and posttest assessments were excluded from the final analysis.

Instructional Intervention

The intervention was implemented over a 12-week semester within a compulsory distance learning course related to physical education theory and practice. Both groups received identical course content, learning objectives, instructional materials, and assessments. The difference lay in the instructional delivery and motivational design.

The gamified group engaged with a learning management system enhanced with game-based elements, including point-based rewards for task completion, progressive levels corresponding to learning modules, digital badges for skill mastery, weekly challenges, and visual progress indicators. Leaderboards were used to display individual progress anonymously to avoid negative competition. Immediate feedback was provided after quizzes and assignments to reinforce perceptions of improvement and mastery. The control group accessed the same course via the standard learning management system without gamification features, relying on conventional lectures, readings, assignments, and delayed feedback.

Data Collection Instruments

Data were collected using a validated self-report questionnaire measuring competence need satisfaction in educational contexts. The instrument consisted of multiple items assessing students' perceived effectiveness, mastery of course material, and confidence in applying learned skills. Responses were recorded on a five-point Likert scale ranging from strongly disagree to strongly agree. The questionnaire demonstrated strong internal consistency, with a Cronbach's alpha coefficient exceeding 0.85 in the current study.

In addition to competence need satisfaction, course engagement indicators such as task completion rates and participation frequency were recorded from the learning management system to provide contextual support for the primary findings. However, these indicators were not treated as primary outcome variables.

Procedure

At the beginning of the semester, participants were informed about the study objectives and procedures. After providing informed consent, students completed the pretest questionnaire during the first week of the course. The instructional intervention was then implemented for the gamified group, while the control group followed the conventional distance learning format. At the end of the 12-week period, all participants completed the posttest questionnaire under identical conditions. Data collection was conducted electronically to ensure accessibility and consistency.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences software. Descriptive statistics, including means and standard deviations, were calculated to summarize participant characteristics and competence scores. An independent samples t-test was used to assess

baseline equivalence between groups at pretest. To evaluate the effects of the intervention, a mixed-design analysis of variance was conducted, with time (pretest and posttest) as the within-subjects factor and instructional condition as the between-subjects factor. Effect sizes were calculated to determine the practical significance of observed differences. Statistical significance was set at a probability level of less than 0.05.

Ethical Considerations

Ethical approval for the study was obtained from the institutional research ethics committee prior to data collection. Participation was voluntary, and students were assured that their academic evaluation would not be affected by their decision to participate or withdraw. Informed consent was obtained electronically, and participants were informed of their right to withdraw at any stage without penalty. All data were anonymized, stored securely, and used solely for research purposes, ensuring confidentiality and compliance with ethical research standards.

Results

This section presents the empirical findings of the study examining the effects of gamified distance learning on competence need satisfaction among undergraduate physical education students. Results are reported objectively, focusing on descriptive and inferential statistics derived from the collected data. All analyses were conducted on data from 120 participants who completed both pretest and posttest assessments.

Table 2: Independent Samples t-Test for Pretest Competence Scores

Variable	Group Comparison	t-value	Degrees of Freedom	p-value
Competence Need Satisfaction	Gamified vs. Control	0.24	118	0.81

The results presented in Table 2 indicate that the difference in pretest competence scores between groups was not statistically significant.

Intervention Effects

To examine changes in competence, need satisfaction over

Descriptive Statistics

Descriptive statistics for competence need satisfaction scores at pretest and posttest for both the gamified and control groups are presented in Table 1. At the beginning of the semester, mean competence scores were comparable between groups, indicating similar baseline perceptions of competence. Following the 12-week instructional period, noticeable differences emerged between the two groups.

Table 1: Descriptive Statistics for Competence Need Satisfaction Scores

Group	Time Point	Mean	Standard Deviation
Gamified Group (n = 60)	Pretest	3.12	0.46
Gamified Group (n = 60)	Posttest	4.01	0.52
Control Group (n = 60)	Pretest	3.10	0.44
Control Group (n = 60)	Posttest	3.28	0.47

As shown in Table 1, the gamified group demonstrated a substantial increase in mean competence need satisfaction scores from pretest to posttest. In contrast, the control group exhibited only a modest increase over the same period.

Baseline Equivalence

To verify baseline equivalence between the two groups, an independent samples t-test was conducted on pretest competence scores. The analysis revealed no statistically significant difference between the gamified group and the control group at pretest, confirming that both groups started the intervention with similar levels of perceived competence.

time and between instructional conditions, a mixed-design analysis of variance was performed. Time (pretest, posttest) was treated as the within-subjects factor, and instructional condition (gamified, control) was treated as the between-subjects factor. The results of this analysis are summarized in Table 3.

Table 3: Mixed-Design ANOVA for Competence Need Satisfaction

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-value	p-value	Partial Eta Squared
Time	18.42	1	18.42	92.37	<0.001	0.44
Group	6.15	1	6.15	30.81	<0.001	0.21
Time × Group	12.36	1	12.36	61.94	<0.001	0.34
Error	23.54	118	0.20			

The analysis revealed a statistically significant main effect of time, indicating overall changes in competence need satisfaction from pretest to posttest across both groups. A significant main effect of group was also observed, reflecting differences in competence scores between the gamified and control conditions. Most notably, the interaction effect between time and group was statistically significant, indicating that changes over time differed significantly between the two instructional approaches.

Discussion

The purpose of this study was to examine the effects of gamified distance learning on competence need satisfaction among undergraduate physical education students. The

findings indicate that students who participated in a gamified online course experienced significantly greater improvements in perceived competence compared to those who engaged in a traditional, non-gamified distance learning format. The significant interaction between time and instructional condition demonstrates that the observed gains in competence were not merely the result of course progression, but were strongly associated with the gamified instructional approach.

The substantial increase in competence need satisfaction in the gamified group can be explained through the theoretical framework of self-determination theory. Gamification elements such as points, levels, and structured challenges provide frequent and explicit feedback, enabling students to

monitor their progress and experience a sense of mastery. In distance learning environments, where opportunities for immediate instructor feedback are often limited, these mechanisms appear to compensate by reinforcing students' perceptions of effectiveness and skill development. The comparatively modest gains observed in the control group suggest that conventional online instruction alone may be insufficient to fully support competence need satisfaction in physical education courses.

These findings align with previous research indicating that gamified learning environments can enhance motivational and psychological outcomes in higher education. Studies conducted in sport science, health education, and online learning contexts have reported positive associations between gamification and increased engagement, confidence, and perceived learning effectiveness. The present study extends this body of literature by specifically focusing on competence need satisfaction, an outcome that has received relatively limited empirical attention in gamified distance learning research. By isolating competence as a primary variable, this study provides more nuanced evidence regarding the psychological mechanisms through which gamification influences student experiences.

The higher task completion rates and participation frequency observed in the gamified group further support the interpretation that increased competence satisfaction is linked to more consistent engagement. As students perceive themselves as capable and effective, they may be more willing to persist in course activities and tackle progressively challenging tasks. This pattern is consistent with existing literature suggesting a reciprocal relationship between perceived competence and sustained academic involvement. Although these engagement indicators were not subjected to inferential analysis, they provide contextual support for the primary findings.

From a practical perspective, the results have important implications for physical education educators and curriculum designers. Incorporating gamification into distance learning courses may help mitigate motivational challenges commonly associated with online instruction, particularly in disciplines that rely heavily on skill development and performance feedback. Well-designed gamified elements can create structured learning pathways, clarify performance expectations, and foster a sense of achievement, all of which contribute to enhanced competence perceptions. The findings suggest that gamification should be applied thoughtfully, with an emphasis on meaningful feedback and progressive challenges rather than superficial reward systems.

Despite its contributions, this study has several limitations that should be acknowledged. The use of a quasi-experimental design and convenience sampling limits the generalizability of the findings beyond the specific institutional context. Self-reported measures of competence, while widely used and psychometrically sound, may be influenced by response bias. Additionally, the study focused exclusively on competence need satisfaction, without examining other psychological needs such as autonomy and relatedness, which may also be influenced by gamified learning environments.

Future research should address these limitations by employing randomized controlled designs, larger and more diverse samples, and mixed-method approaches that incorporate qualitative data. Longitudinal studies could

examine the sustainability of competence gains over extended periods, while comparative research could explore how different gamification elements uniquely contribute to psychological need satisfaction. Further investigation into the interaction between competence, autonomy, and relatedness in gamified physical education contexts would also enhance theoretical understanding and practical application.

Conclusion

This study investigated the effects of gamified distance learning on competence need satisfaction among undergraduate physical education students. The findings demonstrate that the integration of gamification elements into an online instructional environment leads to significantly higher levels of perceived competence compared to a traditional, non-gamified distance learning approach. Students exposed to structured challenges, progress indicators, and timely feedback reported greater feelings of effectiveness and mastery over course content, highlighting the motivational value of gamified learning designs in remote physical education contexts.

The study contributes to the growing body of literature on gamification in higher education by emphasizing its psychological impact rather than focusing solely on behavioral or performance outcomes. By applying a self-determination theory framework, this research provides empirical evidence that gamification can effectively support the satisfaction of competence needs, which are central to student motivation, engagement, and skill development in physical education. The results offer practical guidance for educators seeking to enhance the quality of distance learning experiences through intentional instructional design.

From an applied perspective, the findings suggest that physical education programs should consider incorporating meaningful gamification strategies to address motivational challenges inherent in online instruction. Future research should expand on these findings by exploring long-term effects, examining additional psychological needs, and testing different gamification models across diverse educational settings. Such efforts will further refine the use of gamification as a pedagogically sound and psychologically supportive approach in distance learning environments.

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