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Using gamification in teaching ukrainian as a foreign language to enhance student motivation

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Utilização da gamificação no ensino do ucraniano como língua estrangeira para aumentar a motivação dos alunos

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El uso de la gamificación en la enseñanza del ucraniano como lengua extranjera para potenciar la motivación de los alumnos

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Abstract: *The need to modernize linguodidactic strategies through digital ecosystems necessitates the introduction of gamification to support motivation and reduce cognitive load of foreign students. The aim of the study is to assess the impact of a gamified environment on the Moodle platform on the motivation and academic success of foreign students. The study has a convergent parallel design using linguistic competence testing and motivation questionnaires. Statistical processing included repeated-measures analysis of variance, structural equation modelling, and a bootstrap procedure to test mediation effects. The reliability of the instruments was confirmed through internal consistency indicators ($\alpha > 0.80$) and pilot validation. Significant interaction coefficients demonstrated the higher effectiveness of gamification for increasing success ($F = 28.4$, $p < 0.001$, $\eta^2 = 0.19$) and student motivation. A direct correlation was found between the satisfaction of basic psychological needs and learning outcomes: autonomy – 0.31, competence – 0.29. Previous gaming experience was a significant moderator of the intervention effect at $p = 0.007$. The study confirmed that the systemic integration of game mechanics ensures the transformation of gaming experience into sustainable academic achievements through the mediation of psychological needs. The use of story quests and progression levels guarantees long-term stability of language competencies even after the completion of the active learning phase. Further research prospects include studying the impact of artificial intelligence (AI) elements on the personalization of gamified trajectories and the adaptation of game content to different cultural contexts.*

Keywords: *Academic performance. Communicative competence. Game mechanics. Intrinsic motivation. Moodle platform. Self-determination theory (SDT). Speech culture.*

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Resumo: A necessidade de modernizar as estratégias de ensino de línguas através de ecossistemas digitais exige a introdução da gamificação para apoiar a motivação e reduzir a carga cognitiva dos estudantes estrangeiros. O objetivo do estudo é avaliar o impacto de um ambiente gamificado na plataforma Moodle sobre a motivação e o sucesso académico dos estudantes estrangeiros. O estudo apresenta um desenho paralelo convergente, recorrendo a testes de competência linguística e a questionários de motivação. O processamento estatístico incluiu análise de variância de medidas repetidas, modelação de equações estruturais e um procedimento bootstrap para testar efeitos de mediação. A fiabilidade dos instrumentos foi confirmada através de indicadores de consistência interna ($\alpha > 0,80$) e validação piloto. Coeficientes de interação significativos demonstraram a maior eficácia da gamificação para aumentar o sucesso ($F = 28,4$, $p < 0,001$, $\eta^2 = 0,19$) e a motivação dos estudantes. Foi encontrada uma correlação direta entre a satisfação das necessidades psicológicas básicas e os resultados de aprendizagem: autonomia – 0,31, competência – 0,29. A experiência prévia com jogos foi um moderador significativo do efeito da intervenção com $p = 0,007$. O estudo confirmou que a integração sistémica de mecânicas de jogo garante a transformação da experiência de jogo em resultados académicos sustentáveis através da mediação das necessidades psicológicas. A utilização de missões narrativas e níveis de progressão garante a estabilidade a longo prazo das competências linguísticas, mesmo após a conclusão da fase de aprendizagem ativa. As perspetivas de investigação futura incluem o estudo do impacto dos elementos de inteligência artificial (IA) na personalização de percursos gamificados e na adaptação do conteúdo dos jogos a diferentes contextos culturais.

Palavras-chave: Competência comunicativa. Cultura da palavra. Desempenho académico. Mecânica de jogo. Motivação intrínseca. Plataforma Moodle. Teoria da autodeterminação (SDT).

Resumen: *La necesidad de modernizar las estrategias de enseñanza de idiomas mediante ecosistemas digitales exige la introducción de la gamificación para fomentar la motivación y reducir la carga cognitiva de los estudiantes extranjeros. El objetivo del estudio es evaluar el impacto de un entorno gamificado en la plataforma Moodle sobre la motivación y el rendimiento académico de los estudiantes extranjeros. El estudio presenta un diseño convergente paralelo que utiliza pruebas de competencia lingüística y cuestionarios de motivación. El procesamiento estadístico incluyó un análisis de varianza de medidas repetidas, modelos de ecuaciones estructurales y un procedimiento bootstrap para comprobar los efectos de mediación. La fiabilidad de los instrumentos se confirmó mediante indicadores de consistencia interna ($\alpha > 0,80$) y una validación piloto. Los coeficientes de interacción significativos demostraron la mayor eficacia de la gamificación para aumentar el éxito ($F = 28,4$, $p < 0,001$, $\eta^2 = 0,19$) y la motivación de los estudiantes. Se encontró una correlación directa entre la satisfacción de las necesidades psicológicas básicas y los resultados del aprendizaje: autonomía – 0,31, competencia – 0,29. La experiencia previa en juegos fue un moderador significativo del efecto de la intervención con $p = 0,007$. El estudio confirmó que la integración sistémica de la mecánica de los juegos garantiza la transformación de la experiencia de juego en logros académicos sostenibles a través de la mediación de las necesidades psicológicas. El uso de misiones narrativas y niveles de progresión garantiza la estabilidad a largo plazo de las competencias lingüísticas, incluso tras la finalización de la fase de aprendizaje activo. Entre las perspectivas de investigación futuras se incluyen el estudio del impacto de los elementos de inteligencia artificial (IA) en la personalización de las trayectorias gamificadas y la adaptación del contenido de los juegos a diferentes contextos culturales.*

Palabras clave: *Competencia comunicativa. Cultura del habla. Mecánicas de juego. Motivación intrínseca. Plataforma Moodle. Rendimiento académico. Teoría de la autodeterminación (SDT).*

1 INTRODUCTION

Global geopolitical changes have led to a rapid increase in demand for learning Ukrainian as a foreign language (UFL). The dynamic expansion of the student contingent requires a radical modernization of linguodidactic strategies to overcome specific learning challenges (Jeon, 2022; Zhang; Shakibaei, 2025). The main barrier is the critical cognitive load while learning morphologically complex Slavic language system and Cyrillic script. Traditional methods often do not ensure stable engagement of adult participants, which leads to a decrease in performance over long educational cycles (Oliinyk *et al.*, 2024). There is an urgent need to implement tools capable of supporting intrinsic motivation through interactive digital ecosystems (Grabner-Hagen; Kingsley, 2023).

Gamification is defined as the strategic use of game mechanics, including points, levels, and storylines, in non-game educational contexts. This approach is based on creating a specific experience that transforms routine learning tasks into meaningful and emotionally charged challenges (Ishchenko *et al.*, 2022). Despite the proven effectiveness of game interventions in teaching English, the potential

of gamification for UFL remains theoretically unsubstantiated. The global academic discourse demonstrates the successful integration of digital gaming solutions into foreign language learning, but the adaptation of such models for the Ukrainian context is fragmentary. There is a fundamental contradiction between the wide range of available digital tools and the lack of empirically proven models of their application in the Ukrainian context. The lack of systemic comparative studies on the impact of game elements on the psychological needs of foreign students significantly limits the development of personalized educational trajectories at the international level (Anosova *et al.*, 2022). The need to overcome this methodological gap makes the search for universal mechanisms for stimulating cognitive engagement of education seekers relevant.

Despite the proven effectiveness of game interventions in teaching English, the potential of gamification for UFL remains poorly studied both theoretically and empirically. Existing studies usually ignore the specifics of psychological adaptation of foreign students to the complex morphosyntactic structures of the Ukrainian language system. The lack of validated models of the influence of specific game mechanics on the intrinsic motivation of students creates a significant methodological gap. The study is aimed at solving the existing academic problem by decomposing the game ecosystem based on the Moodle platform. The impact of specific mechanics, in particular RPG levels and story quests, on meeting the needs for autonomy and competence of participants is analysed. The applied convergent mixed design provides a deep triangulation of quantitative indicators with the results of the analysis of reflections on the subjective perception of learning. The resulting model gives grounds to substantiate the possibilities of gamification for increasing the stability of knowledge and stabilizing the motivational profile in the digital UFL ecosystem.

The following *hypotheses* were proposed for testing in the study:

H1: The use of gamification interventions (XP points, badges, quests) is positively correlated with the level of satisfaction of basic psychological needs in autonomy and competence among UFL students.

H2: Satisfaction of basic psychological needs is considered a statistically significant mediator in the relationship between the game learning environment and the academic performance of participants.

H3: Students' previous gaming experience moderates the strength of the impact of gamification on their intrinsic motivation, acting as a factor in strengthening or weakening the effect of the intervention.

The academic novelty of the study is determined by the development and implementation of a comprehensive gaming ecosystem for UFL learning on the Moodle platform. Unlike the use of isolated gaming elements, the approach used is aimed at ensuring a systemic impact on the UFL learning process. The presented analysis of psychological mediators deserves special attention, as it revealed the role of satisfying basic needs in autonomy and competence as factors in the transformation of gaming experience into academic performance. An important component of the novelty is also the substantiation of the stability of the results through the use of delayed testing at the twenty-sixth week to confirm the long-term stability of language competencies. The study design took into account the interaction of gaming stimuli with previous gaming experience and the cultural context of foreign students as moderators of the effectiveness of the intervention.

The aim was to assess the impact of a gamified environment on students' motivation and performance during UFL learning with the identification of psychological mediators within the framework of the Self-Determination Theory (SDT). The aim was achieved through the fulfilment of the following *research objectives:*

1. Analyse the effectiveness of gamification interventions by comparing the dynamics of language achievements and motivation levels in the experimental (EG) and control (CG) groups during fourteen weeks of training.

2. Determine the mediating role of basic

psychological needs in the relationship between game mechanics and the effectiveness of UFL learning using the structural equation modelling (SEM).

3. Triangulate quantitative results with qualitative data to identify subjective factors of student engagement and take into account the moderator influence of previous gaming experience.

1.1 THEORETICAL FRAMEWORK OF GAMIFICATION AND SDT

The methodological framework for studying motivational aspects in the digital educational environment is based on the SDT developed by Deci and Ryan (1985), Ryan and Deci (2000). The presented concept defines intrinsic motivation as a direct result of satisfying basic psychological needs for autonomy, competence, and social involvement. Gamification, represented by the mechanics of points, badges, and levels, functions as a tool for directly supporting the specified individual requests during the acquisition of speech material. The synthesis of studies from 2022–2025 gives grounds to assert the universality of SDT for English language content, but reveals a critical lack of evidence for Slavic languages. One should agree with the conclusions about the lack of data on the mediation of needs, as most authors describe only the students' external behavioural reactions.

1.2 CONCEPTUAL MODELS FOR INTEGRATING SDT INTO LANGUAGE LEARNING

Academic research by Mustafa (2025) and Luu *et al.* (2025) proposes frameworks based on a direct correlation of game mechanics with fundamental personality needs. The need for autonomy is ensured through the possibility of free choice of quests, while competence is reinforced by a system of progression levels and XP accumulation. Analysis of the mentioned models indicates their excessive focus on individual achievements, which often eliminates the role of social involvement (Hakulinen *et al.*, 2013). In our opinion, the combination of AI scaffolding and the concept of flow (Ma; Chen, 2025) is more promising for UFL. This approach allows balancing technological progress with the need for emotional support of international students in specific socio-cultural settings.

1.3 EMPIRICAL EVIDENCE AND META-ANALYTIC DATA ON NEEDS MEDIATION

The results of the meta-analysis by Li *et al.* (2024) demonstrated the differentiated impact of gamification on individual components of the intrinsic motivation of participants in the educational process. The most pronounced positive effect was recorded in relation to the feeling of social involvement and autonomy of students during the performance of educational tasks. The revealed pattern calls into question the effectiveness of simple reward systems without the integration of meaningful elements that provide a sense of professional growth. The use of adaptive quests Journey Through Ukraine in our study is aimed at overcoming this discrepancy by strengthening the cognitive component of the intervention.

The SEM was used to confirm the role of psychological needs as mediators between game elements and academic achievements (Shen, 2024). The integration of the theoretical provisions of SDT with the Technology Acceptance Model (TAM) demonstrates high predictive ability regarding students' intentions to continue their studies (Chen; Zhao, 2022). The high correspondence of the developed models to empirical data emphasizes the appropriateness of using the concept of self-determination to analyse digital transformations in linguodidactics. The combination of psychometric measurements with the analysis of structural relationships provides a deep understanding of the mechanisms of transformation of gaming experience into stable educational outcomes.

Academic research emphasizes the importance of meeting needs for building loyalty to the chosen educational platform (Baah *et al.*, 2023). Combining the ARCS model with the self-determination principles enables identi-

fying the most significant factors influencing the motivational sphere of adult participants. It has been established that autonomous motivation has a significantly stronger impact on the perceived usefulness of digital tools compared to external coercion. A systemic analysis of mediation processes justifies the choice of specific Moodle mechanics to ensure the sustainable involvement of foreign students in the language environment.

1.4 SPECIFICS OF DIGITAL TOOLS

Analysis of the use of specific platforms indicates their high popularity among students, but often records the lack of deep theoretical justification. The study by Degırmencıoglu and Gılanlıoglu (2023) focuses on the general level of engagement without detailing the mechanisms for satisfying basic needs. The use of mobile applications and instant response systems contributes to the growth of achievements, but is rarely accompanied by verification of mediation effects. Most of the studies is based on cross-sectional surveys, which makes it impossible to assess the long-term stability of the formed knowledge and motivation (Huseinović, 2024). The reduction of the samples to Asian contexts creates a geographical and linguistic bias that prevents extrapolation of conclusions to the Slavic language space. Ignoring the participants' previous gaming experience as a moderator significantly reduces the accuracy of existing predictive models. The lack of empirical research on the Moodle platform and specific Ukrainian story quests justifies the academic novelty and relevance of this study. Eliminating these gaps through a systematic examination of mediational relationships will provide a deep understanding of the mechanisms of transforming gaming experience into stable educational outcomes.

1.5 RESEARCH GAPS

An analysis of the current literature from 2022–2025 reveals a number of systemic shortcomings in the study of gaming interventions. Most studies ignore students' previous gaming experience as a potential moderator, which reduces the accuracy of the developed predictive models. This prevents us from differentiating the impact of gamification on active players and individuals without relevant digital experience. Studies are mainly based on short-term sections, which makes it impossible to assess the sustainability of motivation over long educational cycles. The study of sources also indicates a shortage of works using SEM to test mediation relationships. Empirical data are often limited to self-report questionnaires without involving objective analytics of activity log files in digital ecosystems. The geographical concentration of studies in the Asian region creates a significant linguistic bias, leaving the features of Slavic languages out of the community's attention. The lack of coverage of the specific mechanics of the Moodle platform hinders the development of universal methodological recommendations for UFL teachers.

The integration of qualitative methods within a mixed design remains a rare phenomenon, which limits the understanding of the students' subjective experience. Most authors operate with general indicators of success, without taking into account the socio-cultural specifics of game content. The systematic ignoring of the delayed testing stage makes it impossible to verify the long-term effects of the intervention on students' cognitive autonomy. The generalization of the theoretical provisions of SDT with the Technology Acceptance Model (TAM) demonstrates high predictive ability regarding students' intentions to continue studying.

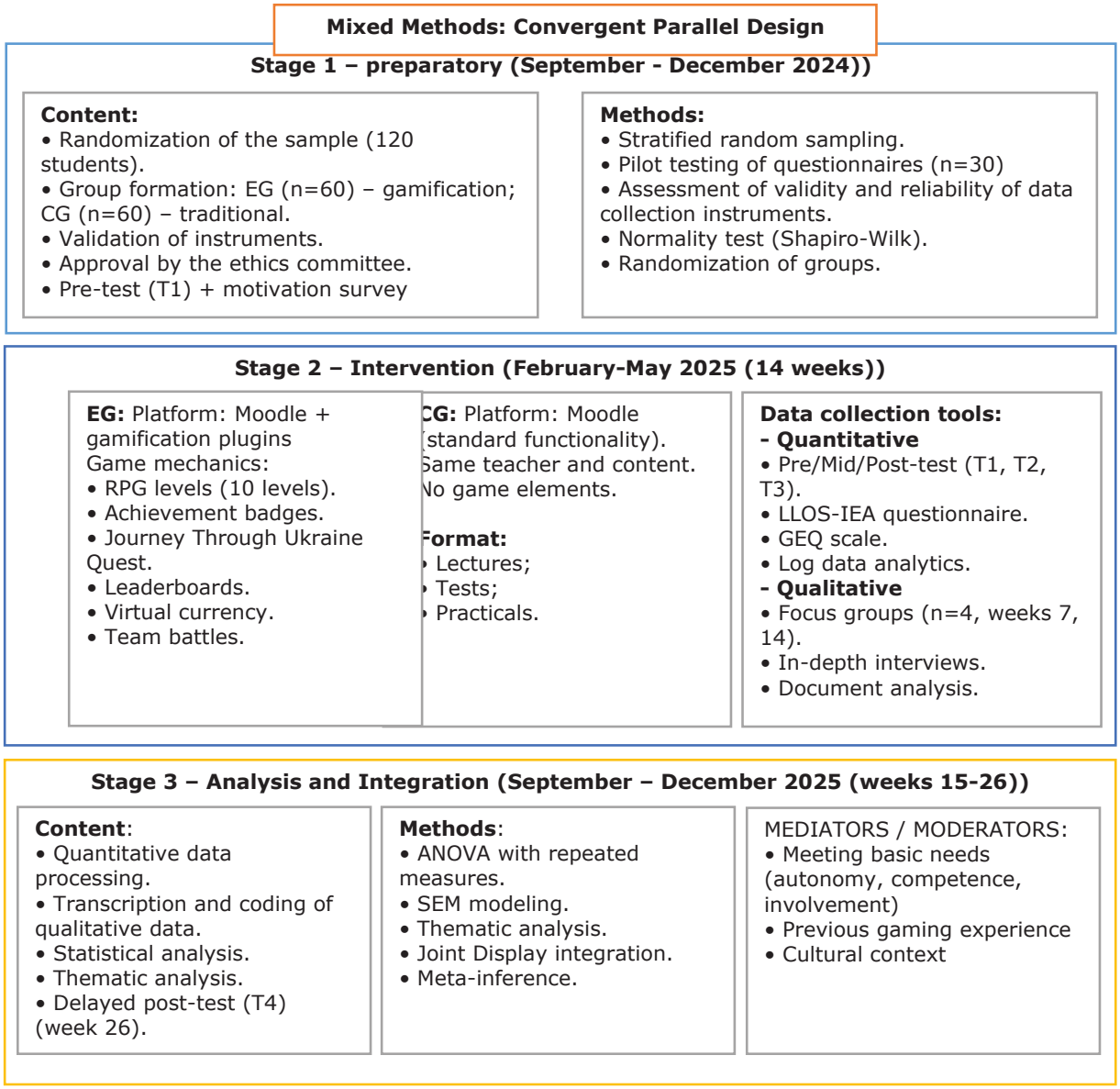
2 METHODS

2.1 RESEARCH DESIGN

The chosen methodological foundation of the study is based on the paradigm of pragmatism, which enables integrating quantitative and qualitative approaches to solving complex linguodidactic tasks. The work implemented mixed methods convergent parallel design,

which involves synchronous collection and independent analysis of different types of data (Creswell; Plano Clark, 2018). The choice of the specified architecture is due to the need to simultaneously verify the effectiveness of the intervention and study the mechanisms of influence through the prism of the theory of self-determination (Shen et al., 2024). The obtained results were subject to triangulation at the interpretation stage to form substantiated integrated conclusions regarding the potential of gamification in UFL teaching. The combination of statistical accuracy with students' in-depth reflections increases internal validity and provides a multifaceted understanding of the processes of participant involvement. Figure 1 presents the stages of the study and their content.

Figure 1 – Research design: gamification in UFL learning



Source: Compiled by the authors based on the collected data (2026).

2.2 SAMPLING AND ORGANIZATION OF EXPERIMENTAL INTERVENTION

The general population consists of foreign students aged 18 to 35 who are officially enrolled in UFL level A1 courses. The total available population at the partner universities was 420 people at the beginning of the study. The minimum sample size was calculated in G*Power 3.1.9.7 using the ANOVA test for repeated measures (within-between interaction) (Faul *et al.*, 2007). The calculations took into account the average effect size (f = 0.25), α = 0.05, power (1-β = 0.80) and correlation between measurements (r = 0.5). Nonsphericity correction (ε = 1) was set. Taking into account the specified parameters, the minimum size was 64 people. The sample was formed by multi-stage selection among 184 students of preparatory departments who started studying the Ukrainian language in the current academic year. The actual study group included 120 people, which met the strict criteria for homogeneity of the data set. This number of respondents exceeds the calculated statistical minimum by 87%. The selected sample size guarantees a power of more than 0.95 even with the possible dropout of 25% of participants during longitudinal observation.

The selection process involved the exclusion of students with prior experience in learning any Slavic languages in order to eliminate the effect of positive language transfer. An additional filter was an entrance diagnostic test to determine the level of language proficiency according to CEFR standards. Participants with A2 level and above were not involved in the experiment in order to maintain the purity of the comparative analysis of the results. The final composition of respondents was limited to individuals with zero or initial level of language proficiency (A0–A1).

The participants were distributed into the experimental (EG, n = 60) and control (CG, n = 60$) groups according to the principle of block randomization using the Random.org service. The procedure included stratification by native language and previous gaming experience to balance the groups in accordance with hypothesis H3. Previous gaming experience was assessed using an adapted Gaming Experience Questionnaire before the start of the implementation of the educational intervention. Distribution concealment was ensured by the method of sealed opaque envelopes to eliminate the subjective influence of coordinators on the formation of group composition. Independent t-tests conducted after randomization confirmed the absence of statistically significant differences between groups in terms of motivation and language abilities ($p > 0.05$).

The study received formal approval from the local ethics committee (IRB) and was conducted in compliance with the confidentiality and voluntary participation principles. All students provided written informed consent for the use of depersonalized learning outcomes and analytical activity logs within the Moodle platform. Confidentiality was ensured by coding identifiers, which made it impossible to establish a connection between personal data and specific performance indicators at the analysis stage.

During the fourteen-week active learning phase, both groups studied identical linguistic content within the digital ecosystem based on the Moodle platform. The experimental condition involved the use of a gamification architecture that included the Level-Up-XP system, story quests, and weekly team competitions between participants. The control condition was reduced to standard LMS features for processing lecture materials and taking tests without game elements or external stimulation mechanisms. The teacher was completely isolated from information about the group distribution of students during classes and work checks (single-blind). The chosen organizational model made it possible to isolate the influence of gamification as an independent variable and minimize the risks of systematic measurement errors. To ensure the reproducibility of the study, the specification of the experimental effect is presented in the form of a comparative characteristic of the conditions (EG and CG). Table 1 describes the structure of the intervention through the parameters of the frequency of use of mechanics and their functional relationship with basic psychological needs.

Table 1 – Comparison of learning parameters in the EG and control CG

Mechanics	Description of impact (EG)	Frequency	Relationship to SDT	Condition CG
XP System	Accrual of 10–50 experience points for timely completion of lexical exercises	Daily	Competence	None
Story Quests	Scenario modules Journey Through Ukraine with the choice of an individual trajectory	Weekly	Autonomy	Linear tests
Team Battles	Group linguistic competitions based on Moodle game mechanics	Every 2 weeks	Involvement	None
Leaderboard	Visualization of the top 10 participants by language proficiency level	Constantly	Competence	Estimates only

Source: Developed by the authors (2026).

The introduction of story quests enabled integrating the educational material into the context of real communicative situations, which enhanced the sense of meaningfulness of learning. The system of progression levels provided constant feedback, confirming the students' mastery of the grammatical structures of the Ukrainian language. Team interaction during the competition was aimed at overcoming social isolation in the conditions of distance education. This experimental design ensures high internal validity of the results due to a clear delimitation of the SDT support tools.

2.3 TOOLS AND LONGITUDINAL MONITORING

Quantitative data were collected at time points T1 (baseline), T2 (week 7), T3 (week 14), and T4 (delayed test). *The Language Learning Orientations Scale – Intrinsic Motivation, Extrinsic Motivation, and Amotivation* (LLOS-IEA) (Noels *et al.*, 2000) was used to diagnose motivation types. It was validated for the context of foreign language learning with a reliability index of $\alpha > 0.80$. Academic results (linguistic achievements) were assessed using standardized tests of Ukrainian as a foreign language (level A1–B1 according to the CEFR), which included subtests for vocabulary, grammar, reading, listening, writing, and speaking. The tests were adapted to the Journey Through Ukraine programme and underwent pilot validation (n=30) with high reliability ($\alpha > 0.80$). The total score was used as an indicator of academic success to compare the dynamics in the EG and CG. The subjective perception of game interaction was assessed by using the Game Experience Questionnaire (GEQ) developed by IJsselsteijn *et al.* (2013). This tool allows for a comprehensive analysis of users' psychological states across several key domains. The questionnaire includes modules for measuring flow, immersion, competence, and emotional response to game mechanics. Using the GEQ provides detailed verification of how the structural elements of Moodle are transformed into the internal experience of international students.

The qualitative line of research involved conducting focus groups at weeks 7 and 14 (two sessions for each group) in parallel with the intervention. After the active phase, twelve semi-structured interviews were conducted with participants selected using purposeful sampling to identify specific educational trajectories. Delayed testing twelve weeks after T3 provided an assessment of the long-term stability of the developed linguistic competencies and the stability of the motivational profile.

2.4 STATISTICAL PROCESSING AND DATA INTEGRATION

Quantitative data were processed in SPSS 28 and AMOS 28 software packages with mandatory testing of normality and sphericity assumptions. The reliability of the instruments was confirmed during the pilot stage ($n = 30$) by calculating Cronbach's alpha coefficient according to the formula:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma^2_{y_i}}{\sigma^2_x}\right) \quad (1)$$

where k – number of scale items, σ²x – total variance, σ²yi – variance of an individual item. The obtained values of α ≥ 0.82 confirmed the high internal consistency of all subscales of the questionnaire. The comparison of mean values between the EG and CG was based on the calculation of the Student's t-test for independent samples:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad t = \quad (2)$$

where $\bar{X}$ – arithmetic mean, s^2 – arithmetic mean, n – size of each group. The applied approach allowed to verify the statistical significance of differences in motivation levels at the initial and final stages of the study.

The dynamics of success were analysed using ANOVA with repeated measures and application of Greenhouse-Geisser correction in case of violation of sphericity. To determine the practical significance of the obtained results, the partial eta-squared indicator (η_p^2) was calculated:

$$\eta_p^2 = \frac{SS_{effect}}{SS_{effect} + SS_{error}} \quad (3)$$

where SS_{effect} – between-group sum of squares of deviations, and SS_{error} is the residual sum of squares. The obtained effect size allowed us to estimate the proportion of variability in success caused by the implementation of gamified mechanics in the Moodle environment.

SEM was implemented using the bootstrap procedure (5000 iterations) to test the indirect effects of mediation of psychological needs. The model was assessed using the CFI ≥ 0.95, RMSEA ≤ 0.08, SRMR ≤ 0.08 indices. The final integration of the results was carried out through the construction of joint displays to compare statistical effects with narrative confirmations of students' subjective experiences (Guetterman *et al.*, 2021). Such a synthesis provided deep data triangulation and allowed us to substantiate the mechanisms of transforming game elements into stable educational outcomes.

3 RESULTS

Before testing the hypotheses, it was confirmed that there were no differences between the EG (n=60) and the CG (n=60) at the T_1 stage. Normality testing (Shapiro-Wilk, p>0.05) allowed the use of the t-test. The results showed that the groups were homogeneous in terms of language level, motivation, and satisfaction of basic needs (p>0.05), which confirms the correctness of the randomization (Table 2).

Table 2 – Baseline characteristics of the EG and CG (T_1)

Indicator	EG M (SD)	CG M (SD)	t(118)	p
Language competence (0-100)	24.5 (6.2)	25.1 (5.9)	-0.54	0.589
Intrinsic motivation (1-7)	3.8 (0.9)	3.9 (0.8)	-0.65	0.517
Autonomy (1-7)	3.5 (1.1)	3.6 (1.0)	-0.52	0.603
Competence (1-7)	3.7 (1.0)	3.7 (1.1)	0.00	1.000
Involvement (1-7)	3.9 (1.2)	4.0 (1.1)	-0.48	0.632

Source: Developed by the authors (2026).

A repeated measures ANOVA revealed a significant interaction effect of Time × Group for achievement (F(3,354)=28.4, p<0.001, η^2p=0.19) and motivation (F(3.354)=21.7, p<0.001, η^2p=0.16). Post hoc analysis showed a steady increase in the EG and a

slowdown in the CG after T_2. At T_4, the EG demonstrated higher knowledge retention (M=75.3, SD=8.1) than the CG (M=58.4, SD=9.2). A between-group effect of η^2=0.42 (p<0.001) was found, for motivation η^2=0.28 (p<0.001). The large effect can be explained by the persistence of knowledge in the EG and fatigue in the CG, which was qualitatively confirmed.

The SEM model (n=120, ratio 10:1) has excellent performance: χ^2/df=2.15, CFI=0.97, RMSEA=0.06, SRMR=0.05. Multicollinearity testing (VIF<3) and alternative models (CFI=0.89) confirmed robustness (Table 3).

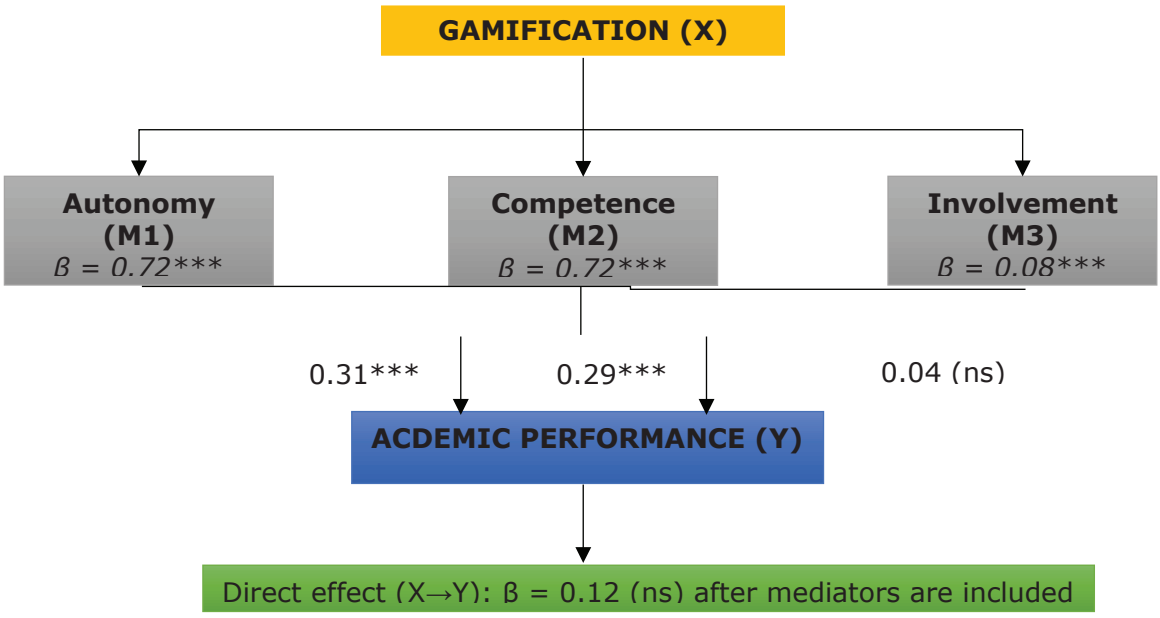
Table 3 – Mediation effects (bootstrap 5000)

Path	Indirect effect (β)	95% CI	p
Gamification → Autonomy → Performance	0.31	[0.21, 0.43]	<0.001
Gamification → Competence → Performance	0.29	[0.19, 0.40]	<0.001
Gamification → Involvement → Performance	0.04	[-0.03, 0.12]	0.285

Source: Developed by the authors (2026).

The direct effect after including mediators is insignificant (β=0.12, p>0.05). The lack of mediation through involvement is explained by the individual nature of tasks in Moodle. Figure 2 presents a mediation model that demonstrates the relationships between gamification, basic psychological needs, and academic performance. The scheme visualizes the path coefficients (β) and significance levels for each relationship, where a dotted line indicates an insignificant effect.

Figure 2 – Mediation model of the impact of gamification on academic performance



Source: Developed by the authors (2026).
Note: *** p < 0.001; ns – insignificant; Model fit indices: χ^2/df=2.15, CFI=0.97, RMSEA=0.06, SRMR=0.05

The model confirms full mediation: gamification affects success indirectly through autonomy (β=0.31, p<0.001) and competence (β=0.29, p<0.001), while the direct effect becomes insignificant (β=0.12, p>0.05). Social involvement does not perform a mediating function (β=0.04, p=0.285), which is explained by the individualized nature of tasks in Moodle. The model fit indicators (CFI=0.97, RMSEA=0.06) indicate high reliability of the obtained results. Moderation analysis using GEQ revealed a significant interaction (p=0.007, ΔR^2=0.08). The overall model explains 52% of the variance in motivation (Table 4).

Table 4 – Moderation analysis

Predictor	b	SE	t	p
Gamification (X)	1.15	0.18	6.39	<0.001
Game Experience (W)	0.32	0.15	2.13	0.035
X × W Interaction	0.58	0.21	2.76	0.007

Source: Developed by the authors (2026).

Simple slope analysis (Johnson-Neyman): for high experience (+1 SD) the effect is stronger (b=1.73, p<0.001), for low experience (-1 SD) – weaker, but significant (b=0.57, p=0.015). Gamification is effective for everyone, but experienced players benefit more.

The final stage of the analysis was the triangulation of data through the construction of a joint display, which demonstrates the correspondence between statistical effects and subjective narratives of participants. This increases the validity of the conclusions and allows for a deeper understanding of the mechanisms of influence. The results are presented in Table 5.

Table 5 – Integration of quantitative and qualitative results

Hypothesis	Quantitative result	Qualitative confirmation	Integrated conclusion
H_1 (influence on motivation)	Significant interaction effect ($p < 0.001$, partial $\eta^2 = 0.16$). Between-group effect at T_4: for knowledge $\eta^2 = 0.42$, for motivation $\eta^2 = 0.28$.	A respondent from the EG compared the learning process to watching a TV series, which stimulated a constant desire to find out the continuation of the storyline (Student 9, EG, week 14). The participant noted the emergence of a stable morning motivation to discover new levels within the gamified platform. In contrast, a representative of the CG described his own activity as a formal completion of tests in order to obtain the required final score (Student 45, CG, week 14). The lack of emotional satisfaction and a purely functional approach to working with the material became key characteristics of the traditional learning experience.	Gamification systematically increases motivation, turning learning into an emotionally charged process, and ensures long-term retention of knowledge. The control group demonstrates decreased interest and a formal attitude.

H_2 (mediation of needs)	Full mediation through autonomy (β=0.31, p<0.001) and competence (β=0.29, p<0.001). No mediation through involvement (p=0.285).	The EG respondent noted a subjective sense of control over her own educational trajectory when interacting with the gamified platform (Student 18, EG, interview). Visualization of progress contributed to understanding the appropriateness of the efforts made and increased the level of satisfaction with the educational activity. In contrast, the CG participant noted the lack of a subjective sense of autonomy and perceived the process as a formal fulfilment of predetermined tasks (Student 33, CG, interview). The lack of an opportunity to influence the structure of learning led to the respondent's passive position and decreased motivational involvement in the traditional educational environment.	Satisfying psychological needs (autonomy and competence) is a key mechanism for transforming gaming experiences into academic outcomes. The lack of autonomy in CG explains the lower motivation.
H_3 (moderation of experience)	Significant interaction (p=0.007, ΔR^2=0.08). Stronger effect for experienced players (b=1.73) vs. novices (b=0.57).	A respondent with high gaming experience described interaction with the platform as using an understandable and familiar communication system (Student 5, EG, week 7). Rapid mastery of the established rules allowed the participant to effectively engage in the educational process and demonstrate high results from the first stages of the intervention.	Previous gaming experience is an important moderator that enhances the effect of the intervention, but does not block it for newcomers, who also demonstrate positive dynamics.

Source: Developed by the authors (2026).

The results of the study fully confirm the advanced hypotheses and give grounds to substantiate the impact of a gamified environment on students' motivation and performance through the satisfaction of basic psychological needs. It was empirically proven that the implementation of RPG levels, story quests and the XP system in the Moodle platform ensures a stable increase in intrinsic motivation and academic achievements of participants. The verified moderating effect of previous gaming experience indicates the need for a differentiated approach when developing gamified curricula for foreign students. The obtained data expand the understanding of the role of digital tools under the SDT and lay the foundation for further personalization of the linguodidactic process.

4 DISCUSSION

The results of the study confirm the high effectiveness of the gamification intervention in the Moodle digital ecosystem for learning Ukrainian as a foreign language. Hypothesis H1 about the positive impact of game mechanics

on motivation and performance was fully empirically confirmed. The significant interaction effect of Time × Group in ANOVA (partial η^2 = 0.19 for knowledge) indicates a stable advantage of the EG. High delayed testing rates at stage T4 (η^2 = 0.42) indicate the stability of the formed linguistic competencies due to the gamified environment. The identified trend is consistent with modern studies demonstrating the long-term effectiveness of game elements in language education (De La Cruz *et al.*, 2023; Zhou, 2024).

Analysis of the results regarding hypothesis H2 confirmed the mediation function of psychological needs for autonomy and competence. The constructed SEM model recorded statistically significant indirect effects for autonomy (β = 0.31) and competence (β = 0.29) as the main drivers of motivation. The role of social involvement was statistically insignificant (β = 0.04, p = 0.285), which is likely due to the predominantly individual format of completing digital quests. Similar limitations of mediation through social needs have previously been observed in other platform-specific explorations (Xiao; Hew, 2024; Chang, 2021). Hypothesis H3 was also confirmed through a significant interaction of variables (p = 0.007, ΔR^2 = 0.08). Gamification demonstrates a significantly stronger effect for experienced players (b = 1.73) compared to novices (b = 0.57).

The results of the study demonstrate a higher predictive power of the SDT model compared to narrowly focused lexical studies (Panmei; Waluyo, 2022; Laksanasut, 2025). Adult foreign students showed a better response to autonomy mechanisms compared to school students, who require more intensive scaffolding. Reliance on the SDT allowed to avoid the risks of demotivation due to excessive competition recorded in studies of mobile applications (Hadi Mogavi *et al.*, 2022). The story quest Journey Through Ukraine provided a deep cultural contextualization of learning, which explains the high effect size at the delayed testing stage. The weakness of mediation through involvement contrasts with studies where team mechanics acted as the dominant factor of involvement (Zeybek; Saygı, 2024).

Critical reflection on the results highlights the problem of motivational duality, where the satisfaction of needs does not always translate into sustained internal engagement (Daliranfirouz *et al.*, 2024; Amalia; Seinsiani, 2026). A similar crisis of social mediation and the limitations of rapid assessment mechanisms have previously been recorded within specific digital platforms (Zhang; Crawford, 2024). The identified gap in indicators between groups highlights the problem of ignoring the stability of individual user types when designing universal interventions (Santos *et al.*, 2023a, 2023b). The lack of a differentiated approach to the gaming experience of participants creates the risk of methodological distortion of the final educational results (dos Santos *et al.*, 2025). Resolving these contradictions requires the implementation of personalized trajectories to level the negative impact of excessive competition.

The study proves the appropriateness of integrating story quests and XP systems to improve the effectiveness of teaching Ukrainian as a foreign language. The obtained data open up prospects for the development of personalized gamification trajectories based on individual user types. Further research should focus on studying the long-term stability of knowledge 6-12 months after the experiment. A comparative analysis of the effectiveness of interventions for Ukrainian and other Slavic languages will allow identifying universal linguodidactic patterns. The introduction of artificial intelligence elements within the SDT concept will ensure the creation of more flexible personalized learning ecosystems.

4.1 LIMITATIONS

The academic reliability of the results is limited by several methodological factors that need to be taken into account in further interpretation of the data. The probable influence of the Hawthorne effect in the EG and the tendency of respondents to social desirability should be considered among the procedural risks. The use of self-report questionnaires increases the likelihood of subjective distortion

of indicators of intrinsic motivation and satisfaction of basic psychological needs. The applied set of precautions, including anonymity and triangulation of methods, minimized the mentioned threats to internal validity.

Contextual limitations are associated with the longitudinal nature of the observation during the academic semester and the dynamics of migration of foreign students. The specifics of studying the Ukrainian language in the era of digital transformation determines the risk of natural dropout of participants due to a change in place of residence. The initial increase in the sample by 30% enabled maintaining the necessary statistical power of the analysis even with the loss of some contacts with the respondents. The geographical concentration of the study within individual university centres may limit the possibility of broad extrapolation of the findings to the global educational space.

It should be noted that the limited sample of A1 level students does not allow for full extrapolation of the findings to higher levels of language proficiency. In turn, the remote format of Moodle may have weakened the sense of involvement compared to face-to-face classes. The use of self-assessment tools for motivation leaves the risk of the influence of social desirability. The single-blind design minimized the teacher's influence, but completely eliminating the subjective factor in digital interaction remains a challenge. Students with low game literacy experienced short-term disorientation at the beginning of the intervention.

5 CONCLUSIONS

The obtained results demonstrate the effectiveness of SDT-oriented gamification for increasing intrinsic motivation and academic performance in learning UFL. The establishment of a significant mediating role of autonomy and competence confirms the importance of the targeted use of story quests and progression levels in Moodle. The results showed that the level of linguistic competencies in the EG increased from 3.1 to 4.4 points, in the CG — from 3.2 to 3.5. The correlation between the indicators of psychological needs and performance in the EG was high: satisfaction of the need for autonomy — 0.72, competence — 0.69, diligence in learning — 0.82. The positive effect of previous gaming experience on motivation was $R^2 = 0.08$ at a significance level of $p = 0.007$ in the EG. The data confirm the effectiveness of integrating game mechanics to improve cognitive autonomy and knowledge retention of foreign students. The academic novelty is the development of a comprehensive game ecosystem on the Moodle platform for a systemic impact on the process of mastering UFL. The mediating role of autonomy and competence in the transformation of game experience into specific academic achievements of foreign students was substantiated. The long-term stability of the formed linguistic competencies was proven through the use of delayed testing at the twenty-sixth week of study. A significant moderating effect of previous game experience and cultural context on the overall effectiveness of the educational intervention was revealed. Therefore, the results of the study can be applied to the development of personalized digital learning ecosystems that contribute to the satisfaction of the students' basic psychological needs. They can be useful for improving pedagogical strategies for distance education and adapting UFL courses to the individual game profiles of participants.

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